AMERICAN MACHINIST

A JOURNAL FOR MACHINISTS, ENGINEERS, FOUNDERS, BOILER MAKERS, PATTERN MAKERS AND BLACKSMITHS.

VOL. 17, NO. 33
WEEKLY.

NEW YORK, THURSDAY, AUGUST 16, 1894.

$3.00 per Annum.
SINGLE COPIES 6 CENTS.

COPYRIGHT 1894, BY AMERICAN MACHINIST PUBLISHING COMPANY.

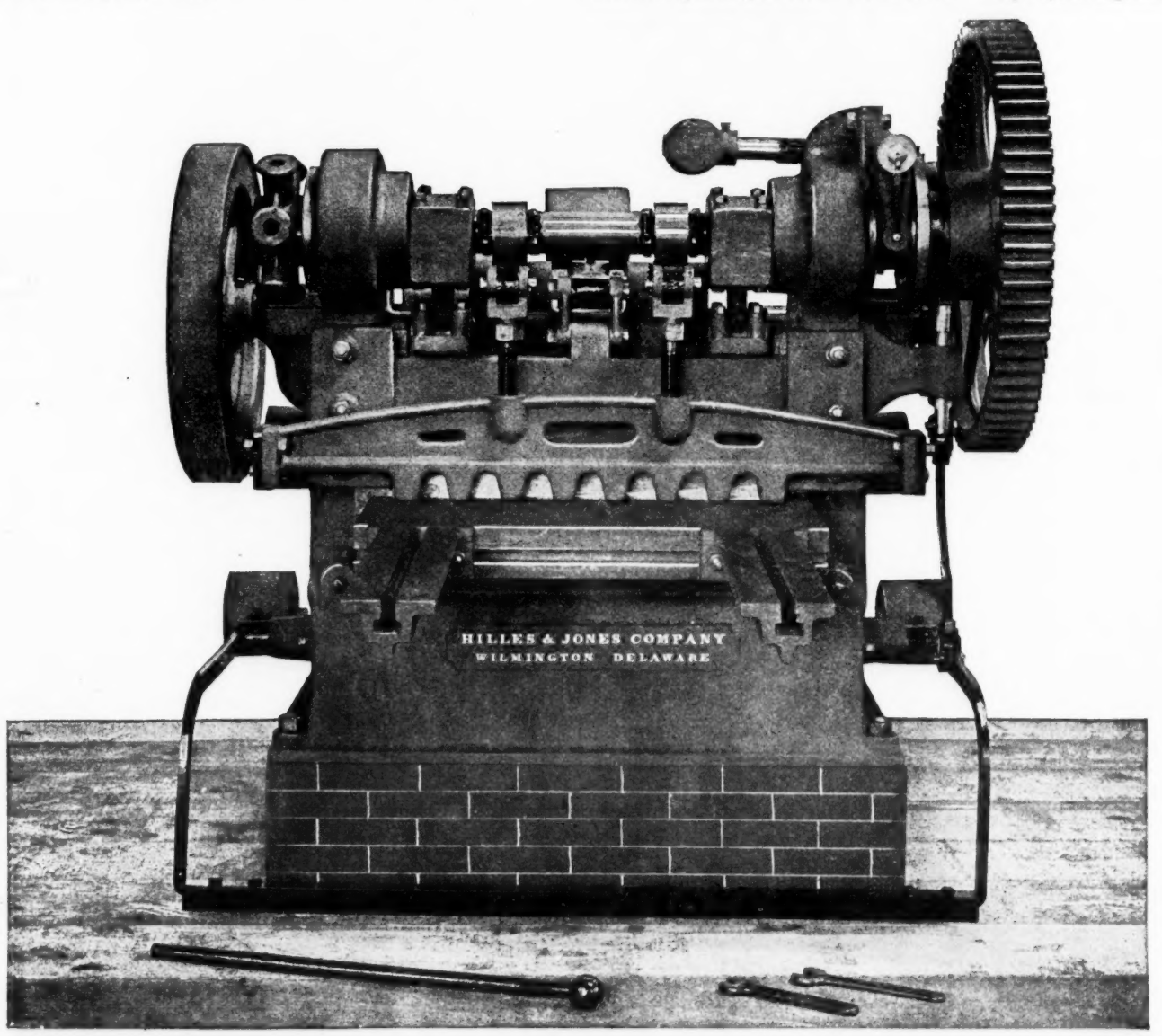
For Sale Everywhere by Newsdealers.

ENTERED AT POST OFFICE, NEW YORK, AS SECOND CLASS MATTER.

Gate Shear.

The Hilles & Jones Co., Wilmington, Delaware, has brought out a convenient little tool for almost any ordinary shearing.

The machine in the cut has a capacity for shearing ¼ inch to ⅜ inch iron 30 inches wide, distance between housings being 32 inches, so that a plate 30 inches wide can be sheared into any required number of pieces. The knives overhang the throat of the housings 6 inches, so that a strip of this width can be sheared from any length of plate. There is one of their improved automatic stops which brings the sliding head to rest at any desired position of the stroke. The clamping is done by means of cams which bring the clamp down upon the plate in advance of the knife striking it, and hold the plate securely while being sheared, and after this operation automatically release it. The sliding head is counterbalanced, and every detail of construction looking to the substantial character of workmanship and convenience has been carefully considered.



GATE SHEAR.

The engine in a shop employing five hundred men stopped for a short time one day. To be exact, it was stopped just nine minutes, which wasn't long. Such things do happen. It only amounted to 7½ days of one man. The engineer was paid at the rate of $2 a day and thought he was doing very good work for the money, which was probably true.

A franchise has been granted to a new gas company in Chicago, the stipulation being that the charge for gas shall be but one dollar per 1,000 feet, and that it shall be of better quality than that at present furnished. And ten cents of this dollar is to go to the city treasury.

Drifts—Drift Jigs—Filling Seams—Peening and Straightening.

BY JOHN T. USHER.

Drifts are used on a variety of machine shop work in a very effective manner, and may be divided into three classes.

First. Plain drifts which enlarge the hole or slot in which they are used by expanding the same. They are used also for drawing one hole or slot into line with some other hole or slot as in boiler work.

Second. Plain drifts which enlarge a hole or slot by cutting the metal away, but which have one cutting edge only, upon one or more sides or surfaces of the drift.

Third. Drifts which enlarge a hole or slot by cutting the metal away, but which have one or all the surfaces of the drift serrated or notched in such a manner as to form a series of cutting edges or teeth.

For brass and composition work the first and second kinds of drifts are the best. For wrought iron and steel work either form of drift may be used according to the requirements of the case. For cast iron work only the second and third kinds of drift can be used.

Figs. 10 to 13 (see page 2) represent the application of the second form of drift in cutting key-ways in pulleys and fly-wheels. Fig. 10 shows the drift which has only one cutting edge.

From the cutting edge *A* the upper surface of the drift is backed or tapered off from *A* to *B* for clearance, .002 inch to the inch in length being sufficient for the purpose. Underneath and on the sides for a suitable distance of, say, from *E* to *F* the drift is made parallel. An advanced guide lip or tongue *C* to *A* is intended to guide the drift when starting a cut. And, for a distance of, say, from *B* to *D* the drift is tapered off on all sides an amount sufficient to allow for the upsetting of the end of the drift, which always occurs when the drift is driven through the work. This form of drift is far superior to the third or serrated form of drift (which is usually employed for this purpose) as it is solid throughout its entire length and has the additional advantage of being easy to grind (sharpen) as often as the cutting edge becomes dull.

Occasionally the sides of the drift are tapered somewhat for clearance from *A* to *B*, but if this is done at all, the amount allowed must not exceed .001 inch to the inch in length, otherwise the drift would, by successive grindings, become too narrow.

Fig. 11 is a sectional view of a pulley hub *A*, with a guide plug *B*, drift *C*, packing shims *D*, plate and bolt *E*, all in position as the key-way *F* is being cut. The guide plug *B* is made a good sliding fit in the pulley hub. A guide groove *G* is then cut in the plug parallel with the axis of the plug on the sides, of the same width as the key-way to be cut, and with an amount of taper on the bottom of the groove equal to that required for the key. The guide groove should in all cases be made deep enough to guide and steady the drift throughout the entire operation of cutting the key-way in the pulley. The thickness of the drift *C* is made equal to the depth of the groove on the deep end, which is equivalent to an allowance for the first cut through the work as the drift approaches the shallower end of the guide groove, when the drift is driven through the work.

The plate and bolt *E*, which spans the bore of the pulley, is intended to hold the drift plug *B* firmly in position. A shim *D*, made of sheet-iron or steel of the same thickness as the cut to be taken, is laid on the bottom of the guide groove after the first and each successive cut taken through the work.

In the design of many types of modern high-speed engines, the governing mechanism, and the eccentric or eccentrics for operating the valves are located in the fly wheel of the engine, or in an extra wheel or disk. The whole of the mechanism, including the governor wheel or disk, being fixed on the crank-shaft of the engine in a position which bears a definite relation to that of the crank pin or crank. In each and every form of this style of governor there is always located at some point on or within the governor wheel or disk, a hub or pin from which an arm from the eccentric (where the eccentric moves across the shaft) or the principal lever or levers of the actuating mechanism (where the eccentric or eccentrics rotate on the shaft) are pivoted, and on these points, more than upon anything else, depends the accuracy of the whole governing mechanism and valve movements. It is, therefore, evident that the key seat in the crank-shaft, and the key-way in the governor wheel or disk may both be cut (by using suitable locating appliances) in such a position as to bear a definite relation to each other, and to the crank or crank-pin of the engine, and that when the governor wheel or disk is properly keyed on the crank-shaft, it will be absolutely correct. To accomplish this in the governor wheel or disk, either one of two methods may be employed.

First. After turning and boring the governor wheel or disk, drill the pivot hole (mentioned above), and then jig from that to the key-way, whether the key-way is cut by machine, drifted, or cut by hand.

Second. To cut the key-way first; and then to locate the holes for the pivot pins from that by jigging.

Figs. 12 and 13 represent the method employed with a jigged drift plug, using the most important pivot pin hole as the location point for the jig. Fig. 12 shows a side elevation, and Fig. 13 end elevation partly in section of governor wheel, and drift plug jig in position ready for cutting the key-way. Similar reference letters denote the same parts in each figure. *A A* represent the drift plug, *B B* arm of jig, *C C* pin for locating the jig in pivot pin hole, *D D* and *E* lug and hub, or boss in which the pivot pins are located, either one of which may be used as the point for locating the jig as preferred; *a a* and *a'* method of attaching or fixing the jig arm to the drift plug, *b* cross plate and bolt.

It will readily be seen that the above principle may be extended to cover the locating of double cranks, which are usually set to a definite angle, as in locomotive practice, and may also be applied to eccentrics and cams which are keyed on the shaft, and to a variety of other purposes.

When working on iron or steel surfaces that are to be nickel-plated, or are to be polished, there is nothing more annoying to the machinist than the appearance of an unsightly seam in some prominent part of the work where it would be impossible to file it out without reducing the work below the size required. In all such cases the seam may be very effectively closed in the following manner without reducing the size of, or weakening the work:

The edges on each side of the seams are raised by means of a small, fine-pointed cold chisel throughout the entire length of the seam; inclining the chisel to the right or left, as shown in Figs. 14 and 15, which are sectional end views of the work with chisels inclined for raising the edges of the seam. When each edge of the seam has been raised as much as required, the bottom or ∧ portion of the seam is then flattened by means of a cold set (chisel ground flat on the end), as shown in Fig. 16. A piece of half-round iron or steel wire is then laid in the seam with the flat side of the wire at the bottom. The seam is then closed by peening the raised edges of the seam down over the wire, unless the seam is a very wide one; its width and depth should not exceed $\frac{1}{32}$ inch after the edges are raised and the bottom flattened.

Fig. 17 is a sectional end view of the work after the seam has been closed. If the job has been done in a workmanlike manner it is impossible, even for an expert, to discover where the seam has been closed

Pieces of larger dimensions can be inserted in iron or steel work in much the same manner by cutting the metal out where the imperfections exist, dovetailing the sides or the end of the work, where the metal has been removed, and then beveling the ends or edges of the piece to be inserted to correspond; the piece is then bent in the center to contract the beveled edges sufficiently to admit of the piece being put into the channel or groove, after which the piece is then expanded by hammering it straight again; the edges are then closed by peening; and the piece filed down level with the surrounding surfaces.

While the insertion of large pieces may be all right in a case of emergency, and if done in such place and manner as not to weaken the work materially, it should only be resorted to in a case of absolute necessity, for at best it can only be regarded as a subterfuge to cover up some imperfection that should not exist.

The peening of metal work by indenting its surface with the peen of a hammer in such manner as to cause the hammered surface to stretch or elongate, in order to straighten, change the shape of, open or close the work, is a method which has been practiced by the machinist from time immemorial, and though it may be advisable in some cases to straighten or otherwise change the shape of the work by this method, still, it can scarcely be said to be good practice where and when other and better methods are available, and it certainly is not what may be termed the approved practice of the day.

In the case of a connecting-rod strap that has to be opened or closed, the opening or closing may be effected in a better if not in a more expeditious manner by heating the strap slightly and making the necessary adjustment by means of a bolt and nut, or in the vise, or by other means; without in any way marring the appearance of the work. For all wrought-iron work, the above or some similar method is preferable to peening in nearly every instance. But for cast-iron work, which is warped or bent, the attempt to straighten or otherwise change the shape of the work by other means than peening is very seldom made, in fact, outside of my own individual experience I do not remember having seen it done more than once or twice. It is nevertheless a fact that cast-iron may be heated and straightened, or changed in shape by pressure, within a reasonable degree, by means of a press, or with a wrench holding

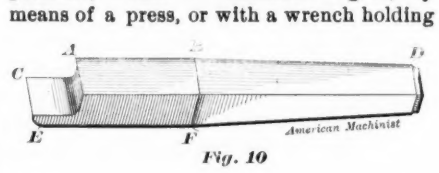


Fig. 10

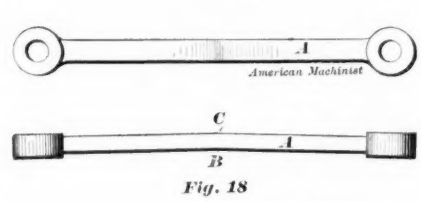


Fig. 18

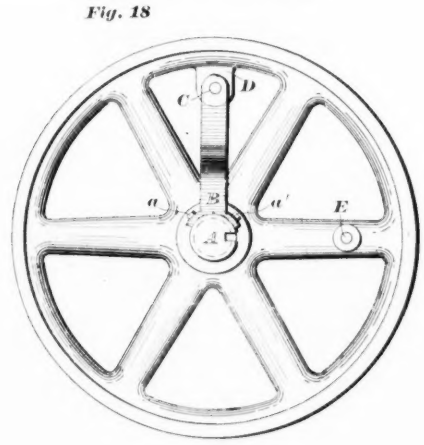


Fig. 12

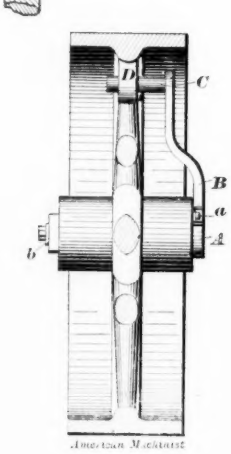


Fig. 13

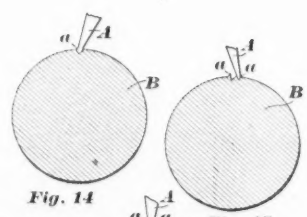


Fig. 14

Fig. 15

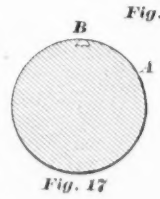


Fig. 17

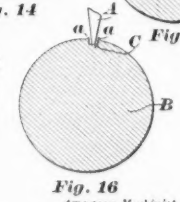


Fig. 16

American Machinist,

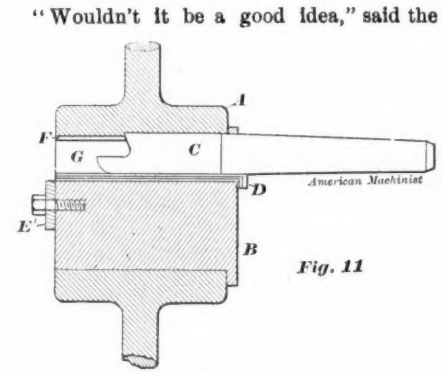


Fig. 11

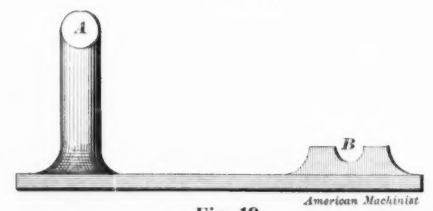


Fig. 19

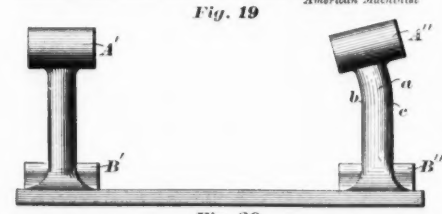


Fig. 20

Drifts—Drift Jigs—Filling Seams—Peening and Straightening.

the work in the vise after it has been heated, or with bolts and straps on the planer or other platen, or by applying the pressure by other suitable means.

Suppose the rod *A* to be bent, as shown at *B C* (Fig. 18). It may be straightened by heating the rod at *B C*, and then applying the pressure at *C*, in any of the abovementioned ways; just as soon as the rod has been straightened the pressure may be relieved and the rod laid aside to cool.

Figs. 19 and 20 represent the casting for a machine frame. The standards and hubs *A A' A''* forming the bearings for one spindle or shaft, and *B B' B''* that of the other shaft. To straighten the standard *A''* (Fig. 20) (which has sprung in casting) to bring the hub in line before boring, the standard is heated to a red heat at *a*, if possible, making it hottest on the side *b*, and only a dull red heat on the side *c*, as in order to straighten the standard, the surface *b* will have to be stretched to the length of *c*, as it is impossible to upset or compress the surface *c* enough to conform to that of *b*. It will therefore be seen that it is easier to stretch the surface *b*, if it is made hotter than that of *c*. As soon as the standard is heated enough the hub *A''* is held in the vise and pressure carefully applied until the standard is straightened. When a piece of work has been treated as above it may, as soon as it has been bent to the shape required, be laid aside to cool, and it will not spring back again even though a cut be taken over the surface which has been bent. This one feature, if there was no other advantage in this method, should of itself recommend it to the intelligent mechanic. Many castings which are now discarded because they have been sprung in casting, could be restored in this manner at a trifling cost. All that is necessary, is ordinary care and judgment.

It was Business.

"Wouldn't it be a good idea," said the disinterested friend, according to the *Chicago Tribune*, "to put a high-grade bicycle in your window and mark it $50 or some such price? You'd lose some money on it, of course, but look at the advertising you would get out of it. Everybody in town would be talking about it inside of twenty-four hours, and your store would get a reputation for selling good machines cheap that would be worth hundreds of dollars to you."

"That's not a bad scheme," said the bicycle dealer, after thinking it over. "John," he called out to one of the boys, "put that Greased Lightning Racer in the front window and mark it $50."

"But" ——

"Never mind arguing the matter. I know what I'm doing."

The Greased Lightning Racer was placed conspicuously in the show window with the $50 tag appended.

"Now," said the disinterested friend, "that looks something like it. You'll see a crowd gathered there inside of five minutes. By the way, you may just consider that machine sold. I'll take it off your hands. But I'm no hog," he added, cheerfully, "I'll let it stay in your window till to morrow morning."

"Wasn't that rather an unhandsome trick?" asked the silent partner, after the disinterested friend had gone away.

"No," reflected the dealer. "That machine has been on hand two years, but it's worth every cent of $47.50."

Accuracy of Refinement in English Coinage.

It may not be generally known that in connection with the operations of the English Mint an interesting ceremony, known as the "Trial of the Pyx," is annually conducted, at the instance of the Goldsmiths' Company, by a jury of experts appointed by that body, and presided over by the Queen's Remembrancer, the object of the trial (which has been conducted now by the Goldsmiths' Company for nearly three centuries) being to ascertain the degree of refinement of English gold and silver coins, and the accuracy with which they approach the standard of value established by legal enactment. The trial this year was held on the 4th inst., at the Goldsmiths' Hall, and some interesting information with regard to the magnitude and accuracy of the coining operations discharged by the mint was furnished in a statement by Professor Roberts-Austin, the chemist and assayer of the mint, contained in the annual report of the deputy master. Professor Austin remarks that: "Before the close of the year 1893 the value of the gold coins issued since the passing of the Coinage Act, 1870, had reached the sum of 100 millions sterling. Of this amount three millions had been coined since the last trial of the Pyx, and had not, therefore, been submitted to the Pyx jury. The average fineness of the 97 millions proved to be 916.647. This average was obtained by applying the results of the assays made at successive trials of the Pyx to the total amounts of gold coins of the several denominations which were represented by the pieces submitted to the jury. Of the 131 gold coins of all denominations here referred to, 49 per cent. proved to be of the most exact standard prescribed by law—namely, 916.6. Only 1½ per cent. of the coins were found to be of so low a standard as 916.2, while nearly 4 per cent. were of the fineness of 916.9, and a single coin was reported as being as high as 917.2.

The average fineness of 71 millions of sovereigns represented was 916.668. It must be borne in mind in reading these statements that gold coins would be within the remedy of fineness, as laid down by statute, if the amount of precious metal they contained varied between 914.6 and 918.6 parts in one thousand.

The tests applied by the jurors to ascertain the fineness of the gold and silver coins are constantly being made more severe by the advance in scientific chemical knowledge, and the weighing is conducted by machines of such delicacy of construction that they are capable of weighing to the one-thousandth part of a grain.—*Practical Engineer.*

There appears to be a most decided exodus of Swedes from this country, with the probability that they will not return. There is said never to have been anything of the kind to compare with it. The returning emigrants say they can get better pay at home than here, which is a most decided change as compared with a few years ago. Such changes may not be so surprising in the future.

A case recently occurred in New York that will perhaps show the advantage of arbitration to employers as well as to employes. The case referred to was one in arbitration between clothing manufacturers and their workmen, and was decided against the workmen, the latter submitting without question.

The Perkins' Draw-stroke Trimmer.

This tool has been on the market for several years, and is well known by bench workers throughout the country. But as no machine, and especially one of this type, can expect to hold the trade unless there are brains enough to make improvements, such improvements have been made, the result being as shown in the accompanying engravings.

One of the features of the Perkins' machine is the means employed for securing the draw cut. This is obtained on their machine by forming the race-way that the knife head traverses circular. On the small machine this curvature is $\frac{3}{8}$ of an inch from a straight line, while on the larger size machine it is 1¼ inches. This dual motion (vertical and longitudinal) to the knife enables it to sever the fiber, somewhat similar to the combined action of a saw and a chisel, imparting an excellent finish to the wood, especially noticeable on pieces worked across the grain.

Another feature special to this machine is shown in the construction of the wing or gauge that the material to be cut rests against while being acted on. These gauges are pivoted to swing from 45 to 110 degrees. The pivots are above and below the knife, and on the exact plane of the cutting edge of the knife. Therefore, the edge of the gauge in proximity to the knife is almost on a dead line with the cutting edge, but slight clearance being necessary, insuring a suitable backing for the wood and preventing breaking or tearing of the edge in cutting. These pivot bearings also prevent the working parts of the wing becoming worn, and the accuracy of that portion of the gauge nearest to the knife-cut being destroyed.

Usually in machines of this type the range of work that could be handled has been limited by the distance between the two outer ends of the gauges when they are set in adjusted inner position.

A device to overcome this fault consists of a link placed on the outer end of the wing, and two gauges—one for the inner adjustment which is set at the outer end of the link, and a second for the outer adjustment or adjustment to cut the greater angle, which is set at the inner end of the link.

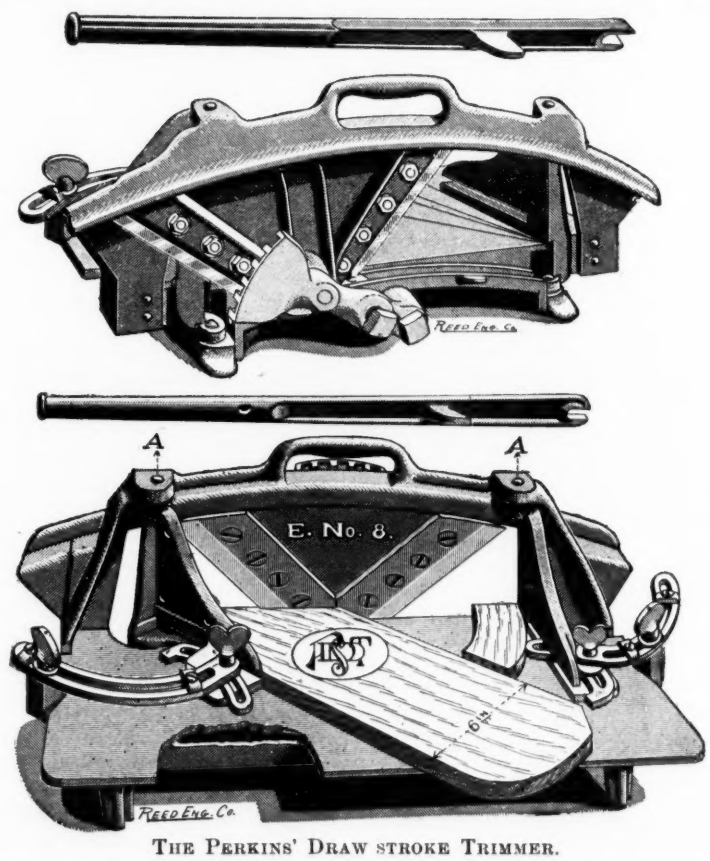
Supposing it were desired to cut two pieces on the opposite bevel, and on opposite wings, of 45 degrees each, then these stops on the link would be shifted back so that as the wing was thrown inward it would determine the angle, the stop striking against a surface provided adjacent to the binding screw. The opposite wing would be set back out of the way while the first angle is completed, then that gauge would be thrown back and the opposite gauge would be thrown forward. The stops would control the angles, and in neither case when these wings were shifted to and from the adjusted position would the angles be changed, altered, or modified, for the stops would be set absolutely on the wing, and would not be interfered with in the shifting of the gauge. As a matter of fact, by shifting the stop to and fro in this manner, in place of having the gauge set by means of a slot in the bed, and a binding screw, and its exact adjustment determined by placing it in opposition with a line upon the bed, the builders say, the capacity is doubled.

The detachable handle and varied positions in which it may be set to suit the operator are still employed. A suitable auxiliary gauge working through a slot in the main gauge or wing is found of great benefit in duplicating work and increasing the scope of the machine generally.

The machine is constructed throughout in first class manner. It also has the proper and necessary take up for overcoming any wear in the head, has sufficient weight to insure its firmness, and to do finely finished work. The bearing for the head is very long so as to prevent any error from the knife traveling in other than an exact curved line.

A handle is provided at the top of the machine by which the tool can be readily picked up and carried in the same manner as an ordinary satchel or grip.

The manufacturers are Perkins & Co., Grand Rapids, Mich.



The Perkins' Draw stroke Trimmer.

Notes on Foundry Management.

By S. Bolland.

No matter what system of tuyeres are employed, it is highly important that means be provided, immediately behind the orifice, for keeping them clean. Slag forms in the cupola, more or less, whether a flux be used or not; its downward course is arrested at the tuyeres, where the action of the blast solidifies, and holds it against the fuel; if no attention is given to this first formation, more slag follows, along with more or less iron, which, finding a ready lodgment at this place, is immediately chilled by the blast. Should this be permitted to continue, the clinkers opposite the tuyeres gradually assume such proportions as to ultimately close them up entirely. During this time the cupola has manifested unmistakably the need of care in this particular, there having been a very sensible falling off in the quality of the iron melted, as well as a gradual diminution in quantity, until, finally, the cupola refuses to yield any more metal, owing to the fact that no more air can be forced in. On attempting to drop the contents of the cupola, it is discovered that a solid bridge has formed over each tuyere, composed of fuel, slag and metal, and, in extreme cases, this may extend clear across from tuyere to tuyere.

It is in the management of tuyeres that the cupola man may distinguish himself. Although the above may appear somewhat exaggerated, it is certainly a truthful representation of what will occur in all cupolas which are being operated up to, or beyond, their legitimate capacity, if means are not taken to prevent it. One thing is certain, the cleaner the tuyeres are kept, the more fluid and fast will the metal melt, and that, with a positive diminution in cost for melting. Therefore, as before stated, let provision be made for easy access to each tuyere by means of a good sized sliding door fitted in the wind box; an eye piece in the door will enable the cupola man to see through to the fuel; if, when the first indication of blackness is observed, he lifts the door and forces in the accumulating slag, it will immediately be melted and disappear. But should this means of prevention have been neglected, and the clinker allowed to form in a mass of sufficient strength to resist a free use of the chisel bar, the introduction of some fine coal may possibly be the means of melting away the offending accumulations. If the coal fails to ignite, then block up the faulty tuyere altogether, allowing the others to supply the blast, until the excessive internal heat has melted it away, when the tuyere may be again opened, and the work proceed in the regular way.

To avoid the loss of heat consequent on the conversion of the ascending gases into carbonic oxide, and thus, when brought in contact with the air, igniting, and passing away unused, cupolas should be made high even though it should increase cost somewhat for the erection of higher charging platforms. The apended table (page 4) shows the height for all cupolas from 24 inches diameter to 84 inches diameter.

Always aim to avoid the heavy draft on the motive power (with its consequent loss for repairs) caused by the increased velocity required to discharge the quantity of air needed through main blast pipes that are too small. In order to save this undue loss by friction it is absolutely necessary that the main blast pipes for the several cupolas mentioned be the diameters indicated in the table, and to obtain effective work in the cupola there should be a blast pressure maintained as per table.

Tuyere area equal to 1½ pipes of 6 inches diameter will serve a 24 inch cupola, but it will require the equivalent of 3½ such pipes for a 36 inch, 6½ for a 48-inch, 13½ for a 60-inch, 19 for a 72 inch, and for an 84-inch cupola, if the requisite volume is supplied, it would require about 30. The tuyere areas given should be adhered to as nearly as possible, no matter what their form or number may be.

Diameter at the tuyeres of common cupolas should remain fixed at 60 inches, and whatever increase is made beyond this should begin immediately above the tuyeres, as beyond 60 inches diameter it becomes impossible to force the blast into the center of the stock.

The size of blowers and power of engines for supplying blast to the respective cupolas will be found in the following table, if other blowers are used it will only be necessary that their capacity be equivalent to those given in table.

If constructed and managed as above directed, a 24-inch cupola should melt at an average rate of three quarter ton per hour, and be amply able to produce 3 tons of molten iron in good condition without suffering any appreciable damage. Nearly 2½ tons per hour might be expected from a 36-inch cupola with about a 9½-ton melting capacity. A 48-inch cupola will yield about 5½ tons per hour with about a 21½-ton limit. Cupolas of 60 inches diameter should rate at 8½ tons per hour, and produce about 33 tons; whilst those of 72 inches diameter should melt 13 tons per hour with a total capacity of over 50 tons. Cupolas 84 inches diameter may, with good management, be made to melt 18 tons per hour for over four hours. The above results are only to be expected in common cupolas when the direction and working is of the choicest kind; engine and blower in good running order; pipes free from leaks, bed fuel thoroughly ignited—but not partially burned away before charging—cupola kept well up with charges evenly laid, fuel and iron free from dirt, requisite pressure of blast steadily maintained, and, last but not least, when every pound of material has been lifted from the *scales* to the cupola in proportions based upon a careful analysis of the result of previous experiments, made for the purpose of testing the merits of the cupola and ascertain under what mode of procedure its capacity could be maintained at a maximum degree of efficiency.

When coal is the fuel used for melting with, the bed fuel should reach about 15 inches above the tuyeres; for coke the height should be 22 inches. The weight of fuel in each case is about the same, but the coal, being more dense and compact, occupies the least space.

Allowing a bottom depth of 10 inches from the sand bed to the under side of tuyeres, the table indicates the weight of fuel required to reach the respective heights, as given for each kind of fuel; also, the weight of first charge of iron, and succeeding charges of fuel and iron to the end of the heat.

The above figures for bed fuel, first charges of iron, and succeeding charges of fuel and iron, will be found, in the main, accurate and reliable, and will serve as a groundwork for basing subsequent experimental practice upon. It is possible, perhaps, to increase the burden in some instances, but any attempt in that direction should be gradual, and effects from such changes as may be introduced should be accurately noted, so that in any new departure the foundry may not be called upon to suffer. The chief end of all cupola practice should be to melt *well mixed and fluid iron*

Charging should commence when the bed fuel is sufficiently ignited, and the stock, when charged, should be allowed to become thoroughly heated before the blast is turned on, as, by this means, the temperature of the iron at the melting zone is raised to almost melting heat, and is immediately reduced with the least possible waste of fuel. From ½ to 1½ hours, according to capacity of cupola, is about the space of time that should be allowed for heating the stock; therefore, in order to be ready for melting, fire should be first started in the cupola at least three hours before the time set for casting to begin.

After ascertaining that the height of the bed fuel is correct drop a few light pieces of iron, carefully, all over the top, but do not choose large flat pieces as some mistakenly do; this prevents a free current of air from passing equally and uninterruptedly into the stock immediately above, and causes irregular melting from the start. When these first pieces have been spread over the fuel in a proper manner other similar pieces may be crossed over them, and thus a perforated iron bed is formed on which to throw the pig-iron and scrap of the first charge without fear of destroying the level surface of the bed fuel, something which is highly essential to begin with. In order to preserve the evenness spoken of use, if possible, all choice pig and scrap for the first charge, taking care that when all the iron is charged the surface may be not only level but of an equal depth throughout. The succeeding charge of fuel must now be introduced equal in depth and level also, on which the succeeding charge of iron is to be thrown. If the iron for all succeeding charges be pig and small scrap, it is only necessary to mix the whole thoroughly together after the manner described, but, if there be a promiscuous lot of scrap, large

and small, to accompany the pig-iron, let the largest pieces be thrown in first as near the center as possible, and surround these with the broken pig and light scrap, observing all the while the importance of packing well up to the walls of the cupola, and filling every interstice with the small pieces; otherwise a too free passage is thereby made for the ascending gases which find their way to the atmosphere above where they take fire and ignite the fuel, thus causing a serious loss of carbon. By charging the bulky pieces first and surrounding them with the lesser ones opportunity is given to preserve regularity in charging, and this very important end is attained much easier when the pig-iron is broken into small pieces. Whilst it may be somewhat laborious to break strong pig-iron into short pieces where there is no breaker used, it is absolutely necessary that it should be done if justice is done the cupola, as it is utterly impossible to charge closely and with due precision when the pieces of pig are too long.

The most elaborate and efficient of the many excellent patent cupolas now in use are made to appear comparatively inferior, because of the violation of correct rules for charging; whilst, on the other hand, very many common cupolas under good management and strict observance of the above-mentioned details are yielding results that compare very favorably with the best.

The reverberatory furnace is, no doubt, the best for melting down very heavy pieces of scrap, but if due precautions are taken it is possible to melt some large pieces in the cupola by increasing the bed fuel somewhat as well as making an addition to the succeeding fuel charge immediately preceding that which contains the piece to be melted, where a still more liberal allowance must be made, around as well as under it. The increase of fuel prolongs the melting operations, and gives ample opportunity for the mass to become well heated before it reaches the melting zone, where, by means of the extra fuel with which it is accompanied, it is gradually dissolved into molten iron.

HEIGHT OF CUPOLA AND DIAMETER OF MAIN BLAST PIPE.

Diameter of cupola in inches	24	36	48	60	72	84
Height of cupola in feet	10	12	13	15	16	16
Diameter of main blast pipe in inches	10	14	18	22	24	26

PRESSURE OF BLAST.

Diameter of cupola in inches	24	36	48	60	72	84
Pressure of blast in ounces	6	8	12	14	16	16

NO. OF BLOWER AND H. P. OF ENGINE.

Diameter of cupola in inches	24	36	48	60	72	84
No. of Root blower	½	2	4	5	6	7
No. of Sturtevant blower	2	4	6	8	9	10
Horse-power of engine	1	3	10	22	35	48

BED FUEL AND SUCCEEDING CHARGES.

Diameter of cupola in inches	24	36	48	60	72	84
Weight of bed fuel in pounds	360	840	1,380	1,920	2,460	3,000
First charge of iron in pounds	900	2,520	4,140	5,760	7,380	9,000
Succeeding charges of fuel in pounds	50	302	554	806	1,058	1,310
Succeeding charges of iron in pounds	500	2,718	4,986	7,254	9,522	11,790

A Woman Boss.

Mrs. Elizabeth Hellman, locally known as "Queen Elizabeth," is the political boss of the town of Williamsbridge, N. Y. She is postmistress, deals in real estate, is a lobbyist at Albany, is a notary public, and has made Williamsbridge a good, bustling town out of the sleepy village it was. Incidentally, she has made $150,000 during the last four years.—*Poughkeepsie Eagle.*

Japan and China.

Just at this writing dispatches go to show that there is a foolish war going on between Japan and China. No one is able to tell what the war is about, and no one will be benefited by it. Men will work harder, not only in Japan and China, but all over the world because of this war, and in some little foolish encounter there will be a "glorious victory," and the thing will be ended. Then more gunboats will be built and there will be another great war, and so it will go to the end.

New Air Brake Practice.

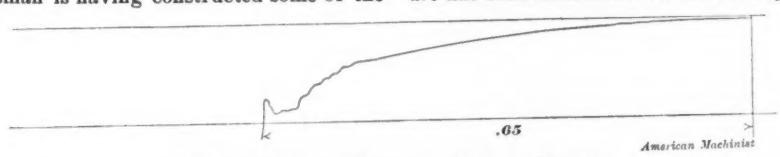
At W. D. Forbes & Co.'s shops, at Hoboken, N. J., I recently met J. Heon Crosman, president of the Standard Brake Company, of 50 Exchange place, New York. Mr. Crosman is having constructed some of the company's brake appliances, and I asked him to write something of them, which he has done, as follows:

In reply to some questions you asked me in relation to our air brake devices, I take pleasure in giving you the following information:

We have a triple valve for air brakes that does not infringe the patents of others, and that is perfectly interchangeable with the air brakes now in use; but it has two very important improvements. 1st. We can release the brakes positively and certainly on 50 or 100 cars; 2d. We can recharge the auxiliary reservoirs, while the brakes are still applied, as well as while they are off.

The device by which we insure releasing any number of brakes with certainty, is a small differential piston, having brake cylinder pressure on the larger area, and train pipe pressure on the smaller area. (We charge up the auxiliary reservoirs through this valve, and not through a charging slot around the triple-valve piston. In this way there is less liability of clogging up from oil and dirt.)

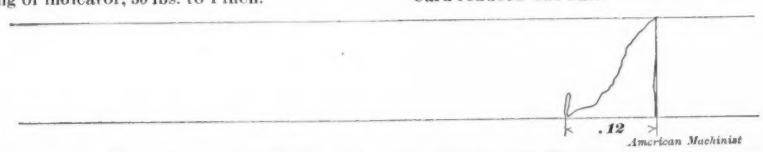
You will see, therefore, that when the brakes have been applied, the brake cylinder pressure acting upon the larger area of this small piston, forces the small piston downwards, closing the port connecting the train pipe with the auxiliary reservoir; and when releasing the brakes, the increased pressure in the train pipe is stored there, exerting its force entirely upon the triple-valve pistons, to drive them to release position, and does not escape into the auxiliary reservoirs until the brake cylinder pressure has been exhausted into the atmosphere, or nearly so, when the train pipe pressure acting on the smaller area of the small piston, is sufficient to overcome the reduced brake cylinder pressure acting on the larger area, the piston is lifted from its lower seat, and the auxiliary reservoirs are charged up evenly and simultaneously.



WESTINGHOUSE FREIGHT TRIPLE VALVE.

69 lbs. Train-pipe pressure.
7-inch stroke of brake piston.
Spring of indicator, 50 lbs. to 1 inch.

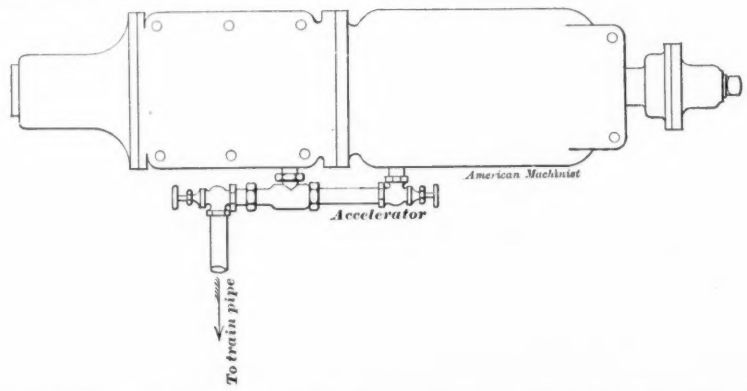
Scale of card, 8 inches to 1 second.
$\frac{6.5}{100}$ of a second to 52½ lbs. in brake cylinder.
Card reduced one-half.



WESTINGHOUSE TRIPLE VALVE (FREIGHT) WITH STANDARD BRAKE CO'S. ACCELERATOR ATTACHED.

69 lbs. Train-pipe pressure.
7-inch piston stroke.
Spring of indicator, 50 lbs. to 1 inch.

Scale of card, 8 inches to 1 second.
$\frac{13}{100}$ of a second to 54 lbs. in brake cylinder.
Card reduced one-half.



The "charging up while the brakes are on" device, is simply a double check valve between the train pipe and the auxiliary reservoir, which upon a slight increase of pressure in the train pipe (which is occasioned by placing the handle of the engineer's valve in the "running position," after an application of the brakes has been made), will just lift, not seat on its upper seat, and allow the increased pressure to equalize with the auxiliary reservoir, but which upon a greater increase of pressure in the train pipe, *will* seat on its upper seat and cause the brakes to release.

This valve is interchangeable with those now in use, but if mixed in with other valves the "charging up" feature would not be used, because the placing of the engineer's valve handle in "running position" is supposed to cause the release of other valves. In that case, the engineer's valve handle would be placed in "release position," when all would release.

Another improvement we have is a device (which, while a part of our triple valve, can also be made separately and attached to other compressed air systems) for applying the maximum pressure on the brakes much more quickly than can be done at present.

I inclose two indicator cards taken yesterday by myself, which show the action of the Westinghouse standard freight triple valve, and the same valve with our "accelerator"—as we have named it—attached to it. You will note the great reduction of time required to reach the maximum pressure. We claim that we shall be able to apply the brakes fully, on the fiftieth car of a train, in at least one-half second less time—and possibly more—than can be done by other triple valves, which means that we will stop a train in a shorter distance.

This is not a re-inforcing device (though we shall have one of our own, also), as we use no additional pressure, but merely apply it more quickly, so that there can be no question of sliding of wheels.

We hope to have a rack test of 50 of our "accelerators" made shortly by the Pennsylvania Railroad Co., and also by the air brake committee of the Master Car Builders' Association, at Altoona; and later on another test of 50 of our triple valves. We shall have an entire system of our own, which will be interchangeable with other systems, and propose to compete to the best of our ability for a share of the business of the railroads. I forward you a blue-print, showing our "accelerator" attached to the Westinghouse air brake equipment.

J. HEON CROSMAN,
President.

The shops of W. D. Forbes & Co. are likely to remind one of what Chordal wrote about fifteen years ago. These shops are genuine machine shops, but they are fitted with modern machine tools for manufacturing general machinery. Chordal's description—the one to which I especially refer, was given up largely to the glorification of the fellow who, just as an every-day occurrence, *whistled* the proper taper in a part of a repair job that could be done, in that shop, in no other way.

In the shop of which I write they get tapers in another way, but there are men working around who could do it as Chordal portrayed. Mr. Forbes was "brought up" as a machinist, and he believes machinists are the best parties to do machine work. You can fill a shop with fine machine tools, but they will not work without the men in front of them.

I noticed under construction some boilers for the navy, such as are used in launches and torpedo boats—a sort of compromise between the Yarrow boiler and something else. These boilers weigh, I think, only about 3,500 pounds, with water complete, but one of them looks as if it would make more steam than a locomotive could use.

There were also under construction some compressed air machines for the navy, four-cylinder engines, and other standard and special machinery.

I believe the main shop is 100 feet long by 35 feet wide, two stories high, with an annex for a blacksmith shop. H.

Setting Valves.

If there is one point in engineering practice that is well-established it is that the only sure mode of setting the valves of a steam engine is with the aid of the indicator. No matter how accurately a valve may be adjusted by actual measurement when the cylinder and steam chest are cold, the conditions may be widely different when steam is admitted. Indeed, in the case of an engine attached to a boiler, it is sometimes impossible to adjust the valves so that the engine will work well, except by actual trial when steam is raised in the boiler. There have been cases in which tests with the indicator have shown derangements of valves that were corrected in a few hours, almost doubling the economy of the engines. So far as experience goes it rarely happens that such a test is made without revealing some defects. Even if these are corrected there is no guarantee that they will continue in adjustment for an indefinite period, and hence the importance of having engines tested at frequent intervals. The saving of one pound of water per hour in an engine of 100 horse power, assuming that the boiler evaporates seven pounds of water per pound of coal, and that coal costs $6 a ton, will effect a saving in the amount expended for fuel of about $130 a year, and not unfrequently a reduction of 20 times this amount is produced in consequence of a test.—*Locomotive Engineers Magazine.*

One of those scenes which do so much to disgrace this country in the eyes of all men who have ever lived under civilized European governments occurred recently at Bridgeport, Conn. A traction company had obtained the right to cross the tracks of a railroad, and were, of course, resisted

by the railroad company. Then followed the holding of trains over the passage way of the traction company, the throwing of steam and water, cutting of hose, etc, all the while there being no opposition to the rioting, that amounted to anything, on the part of the civil authorities. Something similar to this is a thing of daily occurrence in this country. It is unnecessary to say that nothing of the kind could occur in any other civilized country in the world.

Adjustable Electric Lamp Holder.

The illustrations herewith represent electric lamp holders, which must be found very convenient for shop, factory, and office use.

The engravings show the construction so plainly as to leave but little for description, the cuts represent the essential forms of other styles.

Fig. 1 is a single arm holder. The arm is 14 inches long, and works in a bracket screwed to the wall or to a post.

Fig. 4 has a bracket with eyes to slip over ⅜ inch iron pipe, and a horizontally swinging arm, in the outer end of which the curved section works. The combined length of all these sections is 5 feet, so that the lamp can be placed in any inch of the space in a circle ten feet in diameter horizontally, and six feet vertically, beside adjustment up and down the pipe or post to which attached. The pipe may either hang down from ceiling, extend up from floor, bench or desk, or better, reach from one to the other so as to be held at both ends, and be stiff as possible.

Fig. 5 is essentially the same as Fig. 4, excepting that the bracket which supports the arms is made to screw to wall or post, instead of eyes to slip over. The length when extended out from wall is 5 feet, and along the wall 4½ feet either side.

These fixtures are made by Faries Manufacturing Co., Decatur, Ill.

Another Constructive Conundrum—Electricity vs. Compressed Air.

By Oberlin Smith.

Chapter 1.

An occasional reading of the very interesting and useful constructive problems propounded in these columns by Mr. Leicester Allen has reminded me of a very practical problem that was presented for my solution several years ago, and which was solved by the designing and building of several machines which have been running (without appreciable repairs I believe) until this day.

The conditions given me were to produce certain motions, which will be specified further on, in a machine which should cost but a comparatively small sum. A further condition was self-imposed, and was to the effect that there should be not more than a given number of working members, and that these members should be so simple as not to aggregate over a given number of pieces. My success in simplification was unexpectedly great, so much so that it seemed to me, even at this late day, that a description which explained it would interest the readers of the American Machinist. I therefore started to write this article as a full description, thinking the machine in question might prove a companion piece to the curious and ingenious series of articles of Mr. Allen, above referred to, together with their answering solutions.

The machines in question were for one of the largest manufacturing concerns in the country, and their object was to rub with a brush each of the four sides of the "work" which was a rectangular article with a base about 10 inches square, having slightly rounded corners. All four sides were to be rubbed at the same time, each receiving several rapid strokes of a brush, in one direction for a space about ½ inch high, a liquid substance being applied from the brushes by being allowed to slowly trickle thereupon. Referring to the drawings Fig. 1 shows a vertical axial section of the table of the machine T which was about two feet square with rounded corners, together with a part of the pedestal stem P, and two of the brushes B and B'. In Fig. 2 is shown a top view of table T with the four brushes B, B', B'', B'''. The open holes H, H, H, H, were for the brush-supporting arms to pass through, these not appearing in the drawings. They projected vertically, however, from the actuating mechanism below, and curved over inwardly beneath the brushes, being fastened thereto by screws passing through the wooden body of each brush in the holes shown therein

The work was placed upon the table at W, the gauges for guiding it not being here shown as of no importance to the action of the machine. It (the work) was held for an instant by the operator and then lifted off, to be replaced in a second or so by another piece, the brushes meanwhile running continuously. It will be noticed that the central part of the table is somewhat depressed in the form of a shallow pan, this being for the purpose of better holding the liquid which drips from the brushes.

The conditions given were that each brush should move inward and slightly downward toward the work about ¾ inch, thence along parallel with it about 2 inches, thence away and slightly upward from it about ¾ inch, thence parallel with it to starting point.

The path of any given point in the left-hand brush B is shown in top view in Fig 3 by the dotted line, the arrows denoting the respective directions. Another view of one of these paths is shown in Fig. 4, in vertical axial section, where above the broken-away part of the table appears a curved dotted line representing the front view of the inward and outward part of the path of a given point in the right-hand brush B'. This path need not have been curved, but as a matter of fact it was made so for constructive reasons, the conditions given calling for such path being either in a plane or curved in the surface of a cylinder as shown. The speed of these brushes, all moving in synchronism, was about 150 complete strokes per minute. It was immaterial whether the table stood upon four legs or upon a pedestal, but for various reasons the latter method was chosen, the top of the table being about 30 inches from the floor. The whole mechanism was driven by a 2-inch belt upon a small fly-wheel pulley of 12 inches or 15 inches diameter, located beneath the table.

Chapter 2.

The motion was communicated from the main shaft to the * * *. Owing to the reader having "seen stars" this chapter is about coming to an untimely end, and will undoubtedly have to be finished by "some other fellows" among your readers who have the curiosity to attempt a solution, but who, of course, do not happen to be familiar with any of the machines in the factories where they are working. A good solution would embody something still simpler than the actual construction of the machines as built. Others, not so good, will be welcome, and *chapter m* of the treatise, dealing with the *was*, will be contributed by this writer, as the final one, after the conundrum (this word is used strictly in a colloquial sense) has been guessed at, in the way of might-have beens, to the satisfaction of the guessers.

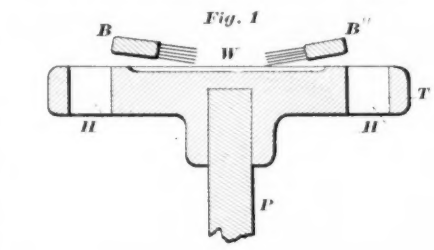


Fig. 1

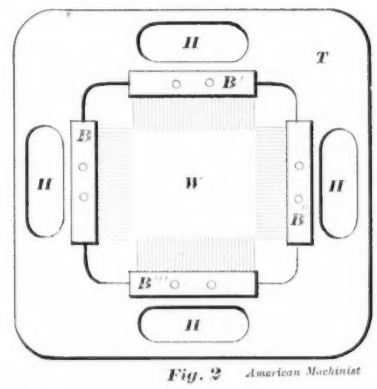


Fig. 2 American Machinist

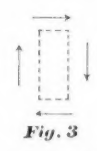


Fig. 3

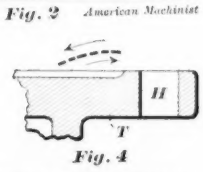


Fig. 4

Constructive Conundrum.

Noticing that your correspondent, Mr. Richards, upon page 8 of your June 14th issue, recommends the use of fire engines driven by compressed air, I write to most emphatically protest against the promulgation of so cumbersome and expensive a system, while we have a means of transmitting the required power electrically by means of mere wires to any desired point within a fire district at a cost vastly cheaper and by devices so much more quickly erected and changed about from one position to another than could be compressed air pipes.

Not only are the latter expensive in themselves, but they involve the digging up of streets which are already so much over dug up, the meshing of more pipes into the vast and tangled up and unsystematic net work which usually already exists beneath our streets, the most careful maintenance to prevent and stop leakage, and an expensive compressing plant as well as motors upon the engine itself which would probably be heavier and more expensive than would electro motors.

It is true that were a compressed air system already installed in a city and were it used for enough purposes that electricity could not be used for, such as direct ventilating, etc., so that it was a permanently paying investment, then the fire-engine scheme in question might be worth considering—especially if the said air pipes were fully supplied to every street in the city. Were they not so supplied the engine would be useful only for certain localities, and might be entirely starved out of action in an important fire where there happened to be no pipe supply. This trouble need not occur with electric wires which can be rapidly strung up in newly built districts, or even, in a covered form, be temporarily unreeled along the surface of the street to supply as yet unwired districts and meet special emergencies of any kind. A good many years ago, before the popular use of electrical power transmission had been dreamed of, I was an enthusiastic advocate of compressed air systems for all cities, regarding them as of almost as much importance to the real well-being of urban populations as their gas and water supplies. It seems to me now, however, that the day for such schemes as this has gone by, and that a younger, cheaper and more agile rival will, by the law of natural selection, see that they are never resuscitated from their tombs.

It is a fact that in Paris a large compressed air plant has been established and applied to a variety of services, but whether fire engine driving is among them I do not remember. It seemed to me to be carefully worked out mechanically, and to be running successfully as far as it went—which was not all over the city, by any means. Whether the enormous difficulties (in the way of keeping tight a few hundred thousands of concealed joints, etc) inherent in any such system have been so overcome as to make the scheme a commercial success I have not recently been informed.

The comparison in my first paragraph between *buried* pipes and wires strung *on poles* would not, standing alone, be a fair one when convenience and beauty in a city's streets are considered. It must be remembered, however, that to bring these points to a common standard wires can be buried in subways along with other wires, with a cheapness and facility of access not attainable in air pipes, and that, on the other hand, pipes cannot be run upon poles nor in any way be made cheap in the numerous cases where cheapness is absolutely essential as a practical condition of their existence.

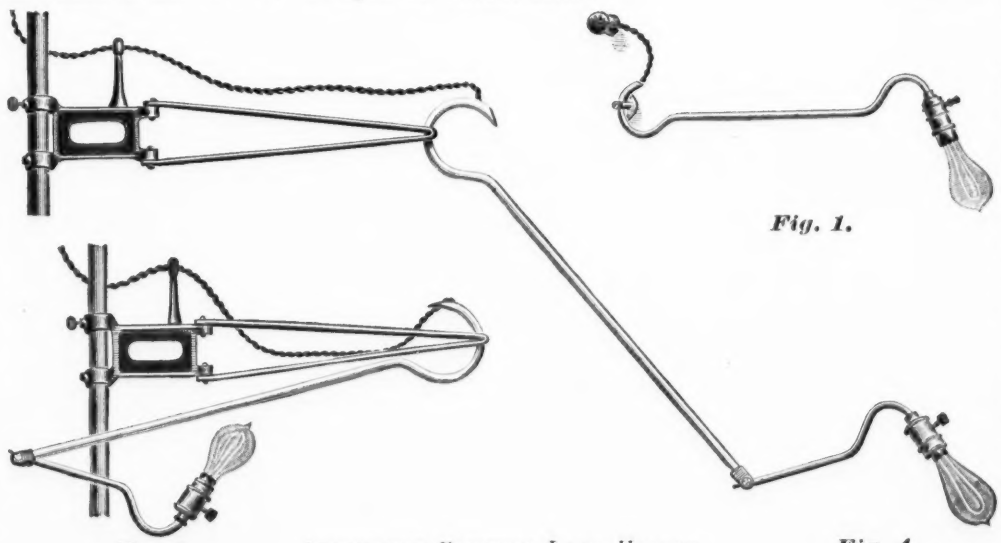


Fig. 1.

Fig. 5.

Fig. 4.

Adjustable Electric Lamp Holder.

Novel Formula for the Increase of Salaries.

The following circular was sent by a chief draftsman to all his assistants. It contains a very novel formula for the yearly increase of draftsmen's salaries adopted in a prominent machine shop. The circular speaks for itself and needs no comment:

In order to avoid the vexation and annoyance on both sides attendant upon applications for an increase of salary, a revision of salaries has been made and a yearly increase of same determined.

Your fixed salary A (a theoretical value for use in the calculation has been set down) is $——, and will be increased yearly according to the following formula:

$$\text{Log. } (10 + 2\,n)\,A.$$

n = number of years of service following July 1st of the date of entering the employ of the company. In your case, your years of service up to July 1, 1892, have been fixed as ———, which number, whether correct or not, is to be used in the calculation simply to make calculation possible, and at the same time to avoid disputes.

The result of the computation will, of course, be somewhat rounded.

In accordance with this fixed scale, therefore, your salary from July 1st will be $—— per month, which salary will be paid to you for the first time August 1, 189—. This salary will be increased yearly according to the above rule. Such increase of salary will be given upon my recommendation on July 1st of each year to each employe of the drawing room who has done his duty the preceding year. But I shall withhold the increase if I have any cause for so doing.

It appears from the annual report of the English Comptroller of Patents that in 1893 applications were made for more than 25,000 patents and 19,400 designs.

A Technical School Wood Turning Lathe.

We present herewith a reproduction of a photograph of a lathe designed and built in the Department of Mechanical Engineering, University of Illinois. In describing the lathe, we cannot do better than print what Prof. W. H. Van Dervoort, M. E., of that institution says about it in a letter. Professor Van Dervoort says:

I inclose you a photograph of a novel form of wood lathe we have recently brought out and styled a "technical school wood lathe," as it has been designed specially for use in technical school shops, yet would be found highly efficient for any class of light turning.

The lathe swings 10 inches over bed, and takes 18 inches between centers. The cone runs on a quill, thus removing all belt tension from the spindle, which is of steel running in an accurately ground taper bearing forward, adjustable to compensate for wear. The tail spindle is ground and accurately fitted to its bearing. The face-plate is removed by means of a wrench fitting a milled hexagon on the hub. The rest is of a convenient form, being locked in both of its principal adjustments by a single screw operated by a fixed wrench at the back.

The lathe is accurately constructed, and may be used to good advantage as a hand lathe for light metal turning, polishing and drilling.

All the necessary special tools and jigs for the accurate, rapid, and systematic construction of these lathes have been provided, and the lathe will constitute one of the principal articles built by our students under the direction of skilled mechanics.

We shall equip our wood shop with twenty of these lathes as soon as possible, arranging them back to back in pairs, and five pairs in a row. Will drive each row of ten lathes with a single belt from the line shaft by using an auxiliary shaft carrying all the drive cones, which will be supplied with friction clutches, so that each lathe may be stopped or started at will.

LETTERS FROM PRACTICAL MEN.

Throttling Engines.

Editor American Machinist:

For the benefit of the manufacturers who, as per issue of July 12th, in spite of the quoted *computed* water consumption of their throttling compound, *believe* that a slight increase of pressure, coupled with additional polishing, etc., of the valve stems, will enable their engine to successfully compete with an automatic of (supposed) proper design, the following simple and (within ordinary limits) correct demonstration of the superiority of cutting off to throttling may not be amiss.

In Fig. 1, let the mean effective pressure of the throttling line *A* 3 *G* be equal to that of the cut-off card line *A B C*, then necessarily the terminal point due to throttling will be above that due to cut off. From *O*—the origin of pressures and volumes—draw the diagonal *O F*, and intersect it by a horizontal—or pressure—line from *G*, as at *H*. Draw *E H* vertical; then *A E* is the cut off due to the amount of steam that has passed the throttle *to give the same mean effective pressure* as is due to the actual cut off *A B*.

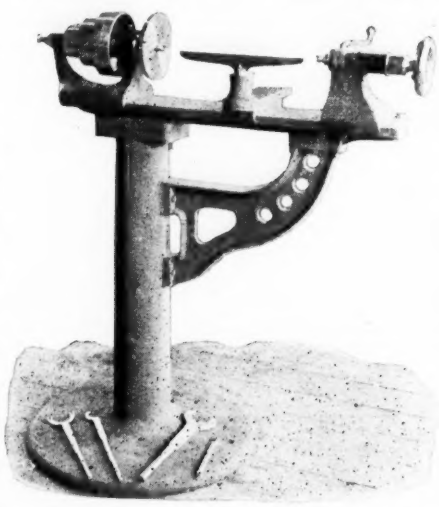
The dead loss due to throttling is, therefore, the volume *E B* of steam at the higher pressure.

The card area would be increased by the portion *A E G* 3 were the throttled volume admitted at full pressure and cut-off at *E*.

Many years ago a song came over the sea from Hirn & Co., to the effect that there was no loss by throttling, but it must not be lost sight of that the conditions of the trials were those of laboratory experiment, and the steam entering in the state of *dry* saturated vapor was transformed into *steam gas* on passing the throttle.

Under the ordinary conditions of practice, steam reaches the throttle supersaturated, and the effect of allowing it to pass into a steam chest where there is a *variable* pressure is to cause it to throw down large quantities of water, and consequently a greater initial condensation (with which it is usually confounded) is recorded.

If steam be throttled *at the boiler* and allowed to flow into a receiver where the lessened pressure is practically *steady*, there is no such loss as that shown by Fig. 1, which diagram relates to steam *in the working cylinder*. Throttling a compound is usually less injurious than "squeezing out" with a simple engine, as the low-pressure expansion reduces the loss, but there is no question as to the most efficient means of



A Technical School Wood Turning Lathe.

governing, *where the engine is properly designed.*

If the valving of the compounds compared is not first class as regards adjustment of cushion, receiver pressures, crank angles, etc., no idea of the relative merits of the systems can be had by perusal of trial data.

It will be found that in the great majority of cases—both with automatic and throttling governing—a large percentage of available energy "slumps" through by expansion in the receivers and waste spaces.

Unless such losses are prevented, any ordinary variation in intrinsic economy, due to reduction of clearance, superheating of steam, or automatic or other system of control, will sink into insignificance; and manufacturers will continue to develop "beliefs" as to their particular products.

The amount of money annually thrown away by self-confident makers of "carefully designed" engines, is something astonishing, when the cost of an opinion by competent authority is considered; but engines are daily foistered upon the already overburdened public, by makers whose only excuse for their crime is that, "Our foreman, who is a man of great practical experience, *believes* that *this gear* will greatly reduce the coal consumption, etc, etc."

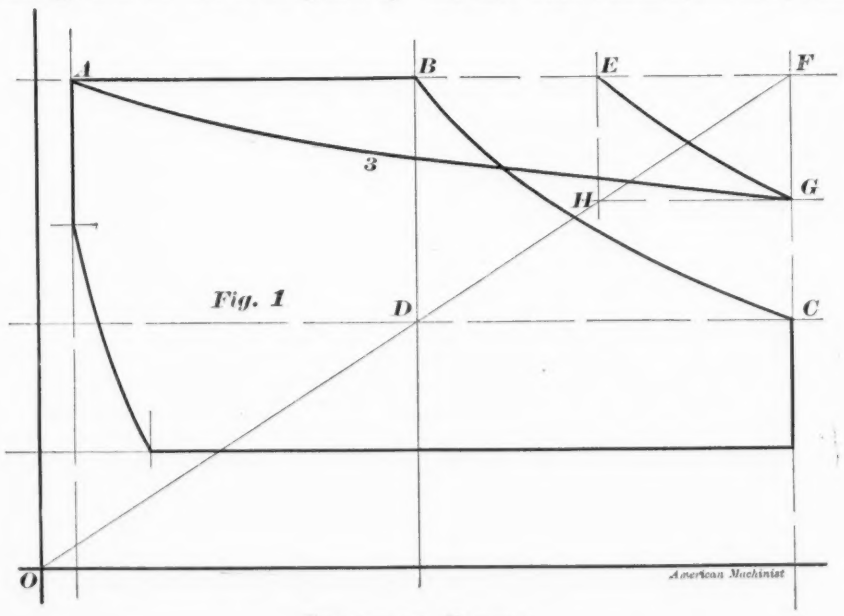


Fig. 1

Throttling Engines.

If the makers quoted in Mr. Stanwood's letter will increase the size of the high-pressure cylinder, reduce (slightly) the high-pressure cushion, and adjust for later high pressure release, and in addition will cut off in the low pressure considerably earlier, they will find a very marked economy result.

If manufacturers would pay some competent man to design their slide valve engines, which by use of the old and little appreciated Forcat cut off can be made perfectly automatic, they could successfully compete with *any* of the Corliss type, but if contented to go on their beliefs, they will continue marching forward—to the rear.

Charles M. Jones.

Buyers and Sellers.

Editor American Machinist:

I think the hoggishness and conceit of the buyer is as much responsible as the hoggishness of the seller, for the custom of high list prices and large discounts. How often have I heard a man say, "That is a good piano; the list price is $600, but I got it for $250." As long as there are such buyers as this in the world (and there will be for several days yet), there will be plenty of sellers to accommodate them, and it is right that there should be, because this is the only way that Nature has provided to teach men common sense: that is, to teach them by experience. Greaser.

The Errors of Indicators.

Editor American Machinist:

The remarks made in the article which appeared in the American Machinist for July 19th, on the accuracy of power measurement by the indicator, doubtless recalled to many their ruminations on this important subject. To those who take a keen interest in the matter, I would specially recommend to peruse a paper by Messrs. Reynolds and Brightmore, read before the Institution of Civil Engineers, London, in 1885, wherein are detailed the results of a number of experiments made with the object of investigating the causes of inaccuracy in the instrument *per se*, and to some extent the errors incurred in its application and manipulation. In the discussion on the paper, the opinions expressed as to the degree of accuracy which was to be expected in the measurement of indicated horse-power, were most diverse, but the paper in question was undoubtedly the means of opening the eyes of hundreds who had previously regarded the instrument as giving results the accuracy of which was altogether beyond question.

Since that time, several more or less carefully prepared papers on the subject have appeared, in which other aspects of the case have been examined, and now, whatever may be the case as regards other branches of steam engineering, it cannot be said that there is any dearth of information on indicator matters.

No one who has given the matter thought can have failed to have perceived how much is expected of the thimbleful of steam which finds its way into the indicator cylinder. Divorced in a sense from the main body of the fluid, the behavior of which it is supposed so accurately to record, our sample of steam is subjected to influences which are absent in the case of the working steam, while it may also be said that some of the causes which greatly affect the latter are, under ordinary conditions, only imperfectly taken account of by the indicator.

As far as regards the cooling of the sample steam due to heat radiation from the indicator cylinder, there is something to be said in favor of the revived suggestion to use larger instruments, since the cooling surface per unit volume of steam would be diminished. But the suggestion runs counter to progress, as exemplified by the latest productions of the instrument makers, inasmuch as it would necessitate a material increase in the weight of the piston. Further, it would entail the use of stronger and less easily standardized springs, while the reciprocating mass of the latter would also be greater. These latter objections would be intensified as pressures increase, and as a matter of fact, it may be said that the tendency is towards the use of pistons of ¼ square inch area for the highest of the pressures now met with.

I must confess my inability to follow the reasoning which leads to the proposal to "make the size of the indicator somewhat in proportion to the size of the cylinder being tested." "Since it is accuracy that is aimed at in the use of the indicator," why should not the small, as well as the large engine, be as accurately indicated as possible? If a larger indicator can be shown to give, in the aggregate, a more accurate reflex of the behavior of the steam in the engine cylinder, why not adopt a larger instrument for general use? But after all is done and said, the main object in view is to ascertain the work obtained from the steam and whether that steam be used in an engine of 10 or 10,000 horse-power, is beside the question so far as comparative results are concerned.

Finally, it may be contended that there is no need for that absolute accuracy in the steam engine indicator to which so much importance is attached. What is required is that all our instruments *shall be all wrong alike*, since in the nature of things they cannot all be perfect. It cannot, of course, be denied that the nearer our standard instrument attains to the ideally perfect indicator, the better, but in arbitrary systems of measurement accuracy of *comparison* is what is required.

Absolute coincidence in these power-measuring capabilities must be a *sine qua non* of the instruments of the future, however nearly they approach the unattainable. What we need is a *standard indicator*—as absolute a reference as our system of screw threads—the foot or the pound. M. E.

Economy in Melting.

Editor American Machinist:

Having read the article of Mr. Hebert Ramp on "Cupola Practice," I have anxiously awaited a reply from some one, but so far no one has written. I take it upon myself to say that I fully believe Mr. Ramp's statements, especially what he says in regard to knowledge being bought with a patent cupola. To prove that I have no patent cupola I will say that those who know are sure that iron has been in it for the last 40 years; at the time previous to that it was a boiler shell. It is a straight cupola throughout, is 26 inches inside the lining, but on account of the size of the main blast pipe and tuyeres I treat it as a 24 inch cupola. The main blast pipe is 6 inches in diameter, and the blower, which is a No. 3 Sturtevant, is one size larger than is needed which, I think, slightly makes up for the air lost by friction in the small main blast pipe. The tuyeres are two in number and are 4½ inches in diameter. The wind-box is ample for the size of the cupola. I have melted in this old fashioned cupola at the rate of 1 pound of fuel to 10 pounds of iron on short heats, and 1 to 12 on long heats, melting on an average of 2 tons per hour and drawing hot metal through the whole heat.

Being an unknown quantity in the field of discussion I will write no more at present, but would like to see more in your valuable

paper in regard to this all-important subject, "Economy in Melting."

E. O. Sawyer.

Expansion and Compression.

Editor American Machinist:

If we take an indicator diagram and find that instead of a smooth expansion line, we have one which looks like a pair of stairs, some of those who claim to know will tell us that it is due to water in the cylinder, but that this is not always the case, the following circumstance clearly demonstrates:

While indicating an engine a short time ago, a friend wished to try his skill at it, but after he had taken several he exclaimed that something was wrong, and as proof showed the diagram, Fig. 1. Now, 15 minutes previous to this he took some which showed a very good expansion line, and this caused us to ask what made the difference? If all of the diagrams showed serrated expansion lines, we might have accepted the water theory, but could not do so unless they were alike in this respect. We proceeded to take off the indicator, and turn it upside down, and pour some oil into its cylinder. After waiting a short time for the oil to work down, we put the indicator into place again, and took another diagram which is shown in Fig. 2.

I consider this ample proof that it was not water in the cylinder that caused the serrated expansion line, but lack of oil in the indicator. I do not claim that water in the cylinder could not produce the same result, for I am not sure about it, but know that it is sometimes due to other causes. In order to produce a smooth expansion line, the piston in the indicator must work freely, but what proof have we that this is the case? If we try the piston before we attach the spring, it proves nothing, except that it will go into place. Perhaps when we put the spring in it will cause the piston to bind, and so produce an expansion line which is misleading. If we attach the spring and then give it a trial when cold and without pressure, it does not prove that it will work equally well at a temperature of 324 degrees, and under a corresponding pressure. I suggest that in all cases where the expansion line is not above suspicion, diagrams be taken with several different indicators, and the results compared. If this plan is not practical, then take diagrams with different springs in the same indicator, and note the difference, taking care to have the piston well lubricated with good cylinder oil.

Sometimes we see diagrams in which the expansion line is smooth, except for a short distance, as shown in Fig. 3. I wonder how many readers have studied out the cause from the effect in such cases. My attention was called to it in the following way: A friend who has had charge of steam plants for many years, was taking some diagrams from his engine. When one of them was about half completed, he heard one of those small explosions which sometimes take place in an indicator and at the same time felt some drops of very hot oil on his arm, which caused him to make some remarks more forcible than polite. When he took the paper off from the drum he found the expansion line serrated, as shown in Fig. 3. Proceeding to take another in which no explosion was heard, he saw that the expansion line was smooth and evenly drawn, but every time that he heard the explosion, its effects were apparent on this line. The explanation is as follows: Particles of cylinder oil collect above the indicator piston and form a kind of bubble which is exploded by heat, thus forcing the piston downward, and when the effect of the explosion has passed off, the spring brings the piston upward, the inertia of the moving parts carrying the pencil up above its normal position as shown. I believe his explanation of the matter to be the correct one.

When an engineer takes a diagram he frequently lays out the theoretical expansion line and compares the actual with it, but I think that the compression line usually receives but little attention. Nevertheless it sometimes tells us of existing defects, or at least points out that an imperfection exists somewhere, and when attention is thus called to it, a thorough examination of the machine sheds light on the subject. Some time ago a society of engineers were invited to visit a large manufacturing establishment where a cold storage system was in operation. They were also asked to indicate the engine which was of the Corliss type. The only peculiarity about the diagrams was in the compression line which was shaped something like Fig. 4. It must be borne in mind that this engine was run 24 hours per day for seven days in each week during the hot weather, so that no chance was afforded for examination and repairs. The connection between the wrist plate and one of the exhaust valves was lengthened, but when another diagram was taken the compression line was the same. Again the connection was lengthened, but still no change, and when it was made as long as it could be, this line was still the same. Nothing more could be done with it at that time, and many times the circumstance returned to the mind of the writer, and I wondered if the mystery would ever be explained. Finally another member of the same society had an opportunity to overhaul this engine, and he found that neither steam nor exhaust valves were long enough to cover the ports. From this it will be seen that steam was constantly passing through the steam and exhaust

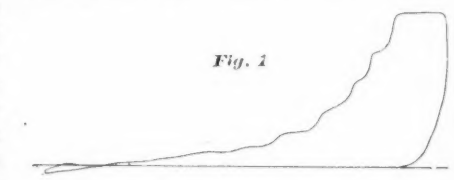


Fig. 1

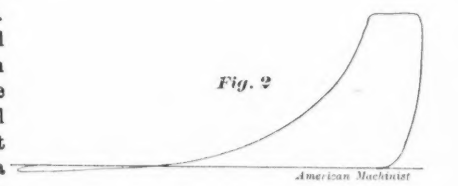


Fig. 2

American Machinist

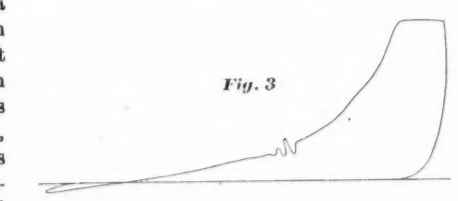


Fig. 3

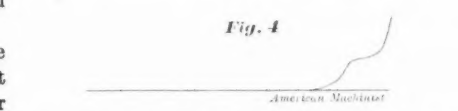


Fig. 4

American Machinist

ports, consequently when the exhaust valve was closed at a point earlier in the return stroke, the compression line was not raised for the simple reason that the steam was forced out of the opening in the exhaust port, and if the valve had been closed when the piston was at mid stroke it would not have given any more compression. Here was a case in which the indicator pointed out the fact that there was something wrong about the machine, but it did not tell wherein the fault was. We frequently read rules which tell us how to lay out the theoretical expansion line, but we seldom find a rule that will determine whether the compression line is correct or not. Mariotte's law for the expansion of gases tells us that if the volume of a gas be doubled, its pressure will be reduced one half, and if the volume be reduced one-half the pressure will be doubled. The latter sentence applies to the compression line of a diagram as follows: If we assume that the atmospheric line is 14 pounds above a perfect vacuum, and we have 2 pounds back pressure above the atmosphere, and the compression line begins to rise at a point one half inch from the perpendicular line representing the clearance space, we would have 16 pounds to begin with, and if we measure the line at a point one quarter inch from this perpendicular line we should have 32 pounds pressure, and at one eighth inch the pressure should be 64 pounds. If it does not follow this line very nearly, tests should be made to ascertain if there are leaks in the exhaust valve or piston.

Directions for locating the clearance line may be of interest. It is plain that whatever relation the stroke of the engine bears to the clearance space in the cylinder and the ports, this same relation must be borne by the length of the diagram to the distance between the end of the diagram at the admission line, and the clearance line.

For illustration, let us suppose that we have an engine with a 48 inch stroke, its clearance being equal to .6 inch more, the diagram taken from it measures 5 inches in length, and from this data we wish to determine the position of the clearance line. It is then an example in proportion for 48 : .6 : : 5 : .0625 or one sixteenth inch. In other words the clearance line must be located one sixteenth inch from the admission line. In this calculation it is assumed that the admission line stands in a vertical position. If it does not then the measurement must be taken from that part of it which is nearest the clearance line.

W. H. Wakeman.

Sound Sense from a Lunatic Asylum.

Editor American Machinist:

The following should be of interest to the readers of the American Machinist, both as a concise and suggestive manual for those who have to do with steam boilers, and from the peculiar circumstances of its production. My esteemed friend, Mr. Frank J. Kennedy, of the Ingersoll-Sergeant Drill Company, was adjusting an air compressor in a lunatic asylum within sight and hearing of some of the inmates. As he passed one of the grated windows a paper was thrust between the bars with the remark, "There, you boiler buster, read and ponder." The paper was a long pink bill form with these verses written in pencil upon the back. They are reproduced as written with a few slight corrections of orthography, etc. Nothing could be learned of the writer.

Frank Richards.

[We append the poem which Mr. Richards hands us, and we haven't a word to say except to try to emphasize the rather threadbare statement—just as true as it is worn—that you don't always have to look outside a lunatic asylum to find a man who knows a good deal. Here are the verses:—Ed. A.M]

BOILER BUSTERS BEWARE!

Much neglect won't be endured
By any boiler *though insured;*
For unexpectedly, you know,
Some day she'll pop, and up she'll go.

Have all your boilers well inspected
And never let them be neglected,
And when a boiler needs repair
Do it at once just then and there.

Never force it beyond its load,
For 'twould be likely to explode;
Keep your water well in sight,
Never below the proper height.

Tubes and flues when they're kept clean
Economy in fuel mean;
And if from scale a boiler is free
It must do well, as you must see.

The masonry must be intact;
The draught is spoiled if that is cracked.
The grate bars should be clear and straight;
Remove all poor ones from the grate.

See that all valves are working right,
The blow cocks must be always tight.
Keep gauges and the gauge-cocks clear,
And then low water you need not fear.

The safety valve should always blow
Whenever the steam gauge point doth show
The working load at which we deem
It's surely safe to carry steam.

Always fire up with greatest care,
There's such a thing as too much air,
Cracks and pockets are not a need;
Try to be regular with your feed.

Over all things have a care,
Never forget the boiler's wear,
Watch well for the unexpected
If from harm you'd be protected.

Let well enough alone. 'Tis true
It's a good rule when said in view
Of useless work; but then 'tis plain
It might in time a loss entrain.

Judgment is needed in any one
Who has a boiler plant to run,
A careless man in a fire room found
May enter but not leave it sound.

A steady hand, a cool, clear head,
A watchful eye will him bestead.
His motions must be sure and quick
When troubles crowd upon him thick.

There's no time then to stop and think,
Things must be done as quick as a wink,
Or else much mischief may be wrought
Before he has the matter thought.

His thinking should be done before,
His plans considered o'er and o'er;
Make all provisions that you may,
You'll find it far the other way.

When danger threatens do not shirk,
But stand up boldly to your work;
'Tis yours to do the saving part,
Work then with all your strength and heart.

'Tis hoped you'll be appreciated,
But if luck and you should not be mated
You'll find at least great satisfaction
In being right in all your action.

Electric Locomotives.

Editor American Machinist:

To what extent some people will carry their ideas is, I think, shown very plainly by the Heilmann electric locomotive, descriptions of the running of which on a French railway are now appearing. Electrical traction has a great place in some people's minds, and this new engine is a curious instance of an endeavor to secure the advantages of electric traction, which its inventor has at heart. These advantages are a possibility of perfect balance of the rotating parts, and, therefore, a uniform continuous rotative effort. So far as this can be effected by picking up current from a conductor beneath the rails or overhead, no one can find fault with electricity for traction purposes, for by means of it tram cars can be run without horses or steam motors.

On one line of trams running north out of London the steam motors have been abolished because residents along the route made such complaints, and certainly these particular engines were, to my knowledge, often very unpleasant, much more so than others I have seen. But all these latter reasons can have no bearing upon the case of the Heilmann engine, for here there is, in the first place, a large steam boiler, and a pair of steam cylinders which are said to be of 600 or 800 horse-power. These drive a dynamo, and this supplies current to the armatures of electric motors fixed on the axles that carry the whole machine, which is 53 feet long. The idea is to run at 100 miles per hour, but if the idea is to secure a good balance of parts, could not this be done with far less complication of parts than are involved in all the mechanism involved in this curious machine?

No transformation of energy can usually be effected at a cost of less than 10 per cent., and in the double transformation from steam power, via a dynamo and motors to traction on the rail, the total loss can hardly be under 20 per cent., nor is it likely that any steam engine can be mounted on a carriage and produce power for less fuel than an ordinary locomotive. Where current is picked up from a conductor the steam engines employed can be of the most economical condensing type, and for such a system electric traction may very easily be understood to be cheaper than detached steam locomotives. Nothing of this applies to the engine under review, and one can only be amazed at its design, which seems to show that its designer has been carried away by the word electric much as years ago the words "by steam power" used to impress people. Indeed, even yet one occasionally sees an advertiser calling himself a maker of certain articles "by steam power."

The difficulty of applying electricity to general railroad work on the picking-up system is doubtless too great to be faced, but should a sufficient call arise for rapid transit between any two cities without branches or crossings, there would be no difficulty in constructing a direct through high speed line on the pick-up system. But is it not extremely probable that we have not yet seen the maximum development of the steam locomotive? This is likely to hold its own a long time for general railroad work, if coal is to be the source of power both for it and for electricity. Given a source of energy that cannot be carried in a condensed form like coal, say a tidal motor, and electricity might step in. Till then we must look on it as merely a transmitter of power, not as a prime mover.

W. H. Booth.

AMERICAN MACHINIST

Communications relating to the reading columns should be addressed to the Editor. All other communications should be addressed:

AMERICAN MACHINIST,
203 BROADWAY, NEW YORK.

PUBLISHED WEEKLY AT
203 Broadway, New York.

HORACE B. MILLER, Pres't and Bus. Manager.
LYCURGUS B. MOORE, Treas. and Sec'y.

F. F. HEMENWAY, Editor and Mech. Engineer.
J. G. A. MEYER, } Associates.
FRED J. MILLER, }

Special Announcements.

☞ *Positively we will neither publish anything in our reading columns for pay or in consideration of advertising patronage. Those who wish to recommend their wares to our readers can do so as fully as they choose in our advertising columns, but our editorial opinions are not for sale.*

☞ *Every correspondent, in order to insure attention, should give his full name and address, not for publication, but as a guarantee of good faith.*

☞ *We are not engaged in procuring patent rights, or in selling machinery, nor have we any pet scheme to advance, or hobby to ride.*

☞ *We invite correspondence from practical machinists, engineers, inventors, draftsmen, and all those specially interested in the occupations we represent, on subjects pertaining to machinery.*

☞ *Subscribers can have the mailing address of their paper changed as often as they desire. Send both old and new addresses. Those who fail to receive their papers promptly will please notify us at once. Date on wrapper denotes week with which subscription expires.*

Subscription.

$3.00 a year in advance, postage prepaid, in the United States, Canada, and Mexico.
$4.00 a year to Other Countries, postage prepaid

Advertising.

Transient, 35c. per line, each insertion.
"Business Specials," 50c. a line.
No Commission allowed to Advertising Agents.

The American News Company,
Publishers' Agents, New York.
DEALERS SUPPLIED BY
The Albany News Company, Albany, N. Y.
The American News Company, New York, N. Y.
The Baltimore News Company, Baltimore, Md.
The Brooklyn News Company, Brooklyn, N. Y.
The Buffalo News Co., Buffalo, N. Y.
The Central News Company, Philadelphia, Pa.
The Cincinnati News Company, Cincinnati, Ohio.
The Cleveland News Company, Cleveland, Ohio.
The Colorado News Company, Denver, Colorado.
The Detroit News Company, Detroit, Mich.
The International News Company, New York, N. Y.
The Minnesota News Company, St. Paul, Minn.
The Montreal News Company, Montreal, Canada.
The National News Company, New York, N. Y.
The Newark News Company, Newark, N. J.
The New England News Company, Boston, Mass.
The New Orleans News Company, New Orleans, La.
The New York News Company, New York, N. Y.
The Northern News Company, Troy, New York.
The Omaha News Company, Omaha, Neb.
The Pittsburgh News Company, Pittsburgh, Pa.
The Rhode Island News Company, Providence, R. I.
The San Francisco News Co., San Francisco, Cal.
The South West News Company, Kansas City, Mo.
The St. Louis News Company, St. Louis, Mo.
The Toronto News Co., Toronto, Ontario, Canada.
The Union News Company, New York, N. Y.
The Washington News Company, Washington, D. C.
The Western News Company, Chicago, Ill.
The Williamsburgh News Co., Brooklyn, E. D., N. Y.
The Wisconsin News Company, Milwaukee, Wis.

The International News Company,
BREAM'S BLDG'S, Chancery Lane, LONDON, E. C., ENG., or Stefanstrasse 18, LEIPZIG, GERMANY, will receive subscriptions for the AMERICAN MACHINIST, at 16/6 per annum, English currency, or 17 marks per annum, German currency, postpaid.
Subscriptions received in Paris, France, by E. TERQUEM, 31 Boulevard Hausmann, at 21 francs per annum, postpaid.

Subscriptions received in Australia by W. WILLIAMS, 17 and 21 Fink's Buildings, Melbourne.

NEW YORK, AUGUST 16, 1894.

CONTENTS

	PAGE
Gate Shear	1
Drifts—Drift Jigs—Filling Seams—Peening and Straightening. By John T. Usher	1, 2
It Was Business	2
Accuracy of Refinement in English Coinage	2
The Perkins' Draw-stroke Trimmer	3
Notes on Foundry Management. By S. Bolland	3, 4
A Woman Boss	4
Japan and China	4
New Air Brake Practice	4
Setting Valves	4
Adjustable Electric Lamp Holder	5
Another Constructive Conundrum—Electricity vs. Compressed Air. By Oberlin Smith	5
Novel Formula for the Increase of Salaries	5
A Technical School Wood Turning Lathe	6
Letters from Practical Men: Throttling Engines. By Charles M. Jones....Buyers and Sellers. By Greaser ...The Errors of Indicators. By M. E Economy in Melting. By E. O. Sawyer....Expansion and Compression. By W. H. Wakeman ..Sound Sense from a Lunatic Asylum. By Frank Richards. ....Electric Locomotives. By W. H. Booth	6, 7
Engineering Schools	8
Best Steam Engine	8
Literary Notes	9
Questions and Answers	9
Blowing Engines	9, 10
Doings at Backaway. By Joel Oldone	10, 11
Economical Shop Management. By Fred. H. Colvin	11, 12
N. A. S. E. Meeting	12
Manufactures	12, 13, 14
Machinists' Supplies and Iron	1,

Engineering Schools.

The columns of *The Engineer* (London) have recently been almost burdened with letters *pro* and *con* regarding the real value to young men of the knowledge gained in engineering schools. The matter was started through the publication of the fact that advertisements for men possessed of such knowledge brought forth rather overwhelming numbers of replies, and a rather plain showing that technical graduates with the title of M. E. were more numerous than the positions they could hope to fill. From this it was inferred that there were too many schools of engineering, which were taking the money of young men—or that of their fathers—without rendering an equivalent.

As against this some of the graduates of these schools showed that they were doing very well, indeed, through the knowledge they had gained at them, and so the discussion has gone on.

The idea of many English engineers appears to be that the proper place to learn engineering is with some engineer, or engineering firm, but as the number of apprentices that can find places with such firms is limited, and the bonus charged a rather large one, the field is not sufficient for all young men who aspire to be engineers. For example, one firm was named that charged 800 guineas for four years, and the applicant must book his name three years in advance, which certainly seems a good price and a long time to wait.

We do not think any such state of affairs exist in this country, as some of the writers referred to say exist in England. It is impossible to say what proportion of the graduates of engineering schools find fairly ready employment, but we think a very fair percentage. Still, the fact should not be lost sight of that the number of graduates is rapidly increasing from year to year, and the demand for draftsmen without shop experience, and those who can otherwise be employed around manufacturing establishments without soiling their hands, is limited. But although it may be the case in England that technical graduates expect to find work at big salaries, directing manufacturing establishments or designing important machinery without climbing the ladder of practical experience, we do not think it is true to any great extent here. The young graduate here is usually eager for practical shop experience on the lower rounds of the ladder, trusting that his college course will make the climbing easier and his hold of the rounds more secure. He is not foolish enough to believe he can learn all about engineering at school, but he believes—and it seems to us correctly—that there are many things necessary for him to know that he can learn there more easily than he can elsewhere. While it is true that some of the greatest of engineers have never had the advantages of a technical education, they have been obliged in some other way—a more laborious way—to obtain a good deal of knowledge similar to that which boys easily get at technical schools, or to use some substitute for it. Probably, these same engineers, if they had not become still more eminent with the advantages of a technical education, would always have found their work the easier for it.

We fail to see wherein the prospects of the graduates of a school of mechanical engineering at the present day are not as good as those of the graduates of a medical college, for example, with the advantage that the engineering graduate has the best chance for making a living at once, that is, if he is not afraid of hard work. The young medical graduate does not expect to find himself forthwith in charge of all the important cases he can attend to. These will come, if at all, after some years of patient waiting, much of the time with nothing to do. The young engineer has the shop to start with, with his school knowledge to back him as opportunities for advancement occur, or if he is content to sink himself then he has the possibility of a draftsman's—not a designer's—wages. In either case—the doctor or the engineer—there is hard and generally unpleasant work before eminence. The doctor does not find distinction thrust upon him as the effect of imaginary diagnoses, nor the engineer through imaginary construction.

In this country as in England and all civilized countries the profession—if it may be so called—of engineering is overcrowded just as all other professions are. And this is always likely to be the case. Many graduates of engineering schools will find themselves working for years scarcely better off than if they had never had school advantages while others will rise rapidly. This is so in everything. There are many who contrive to graduate from engineering schools who could not, with the best opportunities in the world, make any use of the knowledge gained there. In the case of others it may take considerable time for them to find their level. Others still may never find it. But take it all in all we fail to see that such graduates are not as well equipped as those in other professions.

The mistake is no doubt often made of sending a boy to an engineering school under a sort of vague impression that engineers are able to make about so much a year, and hence he will be provided for to that extent. Of course, nothing of the kind is true. After graduating he must fight his way with a good many others in a world in which there is no more than a living for most workers. If he has the faculty of using his technical knowledge to advantage, a faculty a good way above the average, he will succeed. Otherwise his success will be no more than commonplace.

The Best Steam Engine.

What will always seem like a mistake to outside engineers is not infrequently made by the builders of steam engines in assuming that the particular type of engine they build is the best for all purposes for which steam engines are used. All will remember the rather warm contention of a few years ago regarding the relative merits of high and slow speed engines. Expressions of opinion were rather positive on both sides, but if the arguments made did not entirely convince the builders of either type that there was room for the other, they did have some effect in the way of confirming this belief in the minds of others, so that today there are uses for which it would be useless to attempt to sell a high-speed engine, and others for which a low-speed engine would find no favor.

For the requirements of steam engineering go beyond the question of rotative speed, and one requirement will come strongly to the front in one place, or for one purpose, and another for another purpose.

Fuel may be so plenty in one location as to cut no figure in determining the type of engine to be used. In fact, in the instance of saw and lumber mills it is frequently the case that it is an advantage to burn as much of the refuse as possible under the boilers. And this may be the case in tanneries, and in the instance of engines used for other purposes. Now, under such circumstances it would be of no avail to talk to those wanting engines about the saving of fuel. Fuel is the one thing that it is not economical to save. So the saw mill, the lumber mill and the tannery have their special requirements. They are usually located in what may be called out-of the way places. The engines used in them are generally rather roughly handled, and there is no near-by machine shop to go to for repairs. Manifestly the requirements are for engines that will hold together under the rough usage they receive, and in the construction of which there is nothing that cannot be comprehended by the village doctor. Refinements for steam saving or for other purposes would be as much out of place as polish on a grate bar. What is wanted is something that will turn over right along without regard to pounds of steam or pounds of fuel, that is as near as possible proof against breakage, and utterly devoid of complication. There are many high class engines that never ought to be bought or sold in such locations. Their refinements would be materially worse than wasted; a cause for dissatisfaction rather than for satisfaction. They would not be worth a moment's consideration until they gave trouble some day beyond the skill of local talent to cope with.

Transplant the saw-mill engine where coal is worth five or six dollars a ton—where there is no waste material for steam making—and, of course, it is all wrong. The conditions are as unfavorable now as they were favorable before. Fuel must be carefully considered, and to this end devices or parts that may be more liable to derangement will be tolerated. Better talent is employed around the engine and the machine shop is at hand.

Here, then, in the two instances cited is a place for two types of engines—the one that is nothing but an engine, a machine that one couldn't do much to or for if he tried, and that is little liable to require the doing of anything until it goes "all at once" or requires a complete rebuilding, which it will hardly be worth, and the one upon which greater care can well be afforded to the end of saving fuel. Neither is suitable for the place occupied by the other.

The foregoing is a strong contrast; there are other requirements that may not seem so striking, but which may be of consequence. For example, the requirement may be for the nearest practicable approach to absolutely uniform turning, something beyond what would be of any particular advantage in the instance of the majority of steam engines. There are types of engines better suited to accomplish this end than others are, and so on, other examples might be given if necessary. Enough has already been said to show the unwisdom of claiming for any single type of engine the advantages that can belong only to all.

Theoretically speaking, it might be reasoned that every steam engine should have all the good features of a dozen types, or at least all that it was possible to embody. Practically, there would be waste in this. In the machine business there are required for some purposes tools and machines of great precision, tools and machines that cannot be made too well, no matter what the cost may be. But for a large part of the work of the machine shop something that costs much less is equally as good—in some instances better. It would be foolish to reason that all the tools and machines should be made like the more costly ones, just as foolish as to reason that the costly ones should not be made. To a certain extent this is true of steam engines. No single builder builds the best for all purposes.

It is a positive misfortune that there are so many text-books, pocket-books and the like, whose authors in many instances know nothing of nine-tenths of the subjects treated. Frequently it is found that the authors of such books lack the ability to transcribe correctly, which only increases the misfortune. Then there is a feeling against literal copying, and the effort to change the text which is not comprehended in the first place, multiplies the mistakes.

The great majority of those who use handy engineers' books are busy men who have neither time nor inclination to go through calculations and reasonings to verify rules and formulas. They expect they have paid for that in paying for the book.

What is wanted by mechanical engineers is not a multitude of pocket-books, cheap in every sense, but one or two upon which sufficient time and intelligence have been expended to insure reasonable initial accuracy, according to present light and which will receive revision by their authors or be allowed to go out of print in the course of a few years. Such books, unless they are the subject of constant revision, soon lose all their value except in the matter of standard tables and stereotyped information. It is only by continual revision that an engineers' pocket book can be kept up to what men are constantly learning in their every day business.

Strikes and the so-called settlement of strikes reminds one who thinks very much of the relations between capital and labor that human nature is the same thing on whichever side of the fence it may happen to be. If a workman feels himself by force of circumstances, just then out of his control, obliged to submit to what he believes a plain injustice, more of his thought is given to "getting even" than to doing his work, whatever that may be. And this feeling grows on him with time and will find expression when the opportunity comes. The same in degree, modified only by the different conditions, is true of the employer. If this were different it would probably, somehow, be worse. At any rate, it will never be different, so it is not worth while to speculate on what might be. Strikes and lock outs settle nothing.

Literary Notes.

Pocket Primer of Air brake Instruction is the title of a little hundred-page pocket-book to which the name of W. S. Rogers is put as author. The writer has been engaged on one of the large roads of the country in the role of instructor in air-brake matters, which is, perhaps, what has made it easy for him to tell in a simple way what engineers and firemen will want to know. The little book sells for the small price of 50 cents by the author, W. S. Rogers, Troy, N. Y.

Questions and Answers.

Questions of general interest relating to subjects discussed in our columns will receive attention in this department. The writer's name and address should always accompany the question. Neither correct initials nor location will be published when there is a request to that effect. If questions are enclosed with a business communication, they should be written on a separate sheet.

(378) A. B. C., Newport, Ky., writes: Please describe the process of galvanizing small castings. *A.*—See answer to Question 229 in our issue of May 10th, current volume.

(379) H. C. F., New Albany, Ind., writes: I think there is a book published containing the series of papers read at the World's Fair Congress. Among these was a paper relating to the proper education of engineering students. Kindly inform me as to price, title and publisher. *A.*—John Wiley & Sons, 53 East Tenth street, New York City, have published these papers in book form. Write to them for particulars.

(380) F. W. B., Trenton, N. J., writes: I have a 56 inch turbine wheel running under a 12 foot head. It does not give the power it should do. The tail water is about 2 feet from bottom of wheel, and the tube extends 2 feet 3 inches under the water. My theory is that the water passing through the wheel cannot get away fast enough. Am I right? *A.*—We cannot give a decision without knowing more of the details and type of wheel used.

(381) J. B., St. Louis, Mo., asks: Is there a book published treating on brass work, including casting, spinning, polishing, lacquering, with receipts for same and brass work generally? *A.*—We do not know of a book which treats on all of the above subjects. 2. Is there any metal that will mix with zinc and keep it from cracking in casting rings around gas pipes? *A.*—Tin and zinc unite readily in all proportions. A few trials should indicate which proportion will suit your purpose the best. The following may be of service to you: 75 parts of zinc, lead 4 5, antimony 2.5, and tin 18 parts, all by weight.

(382) G. E. W., St. Louis, Mo., writes: Please give me a list of all the State institutions which give a good course in mechanical engineering. *A.*—The following are State institutions, or schools in which the tuition is free to residents of the State or city only: University of Virginia, Charlotteville; Ala. Polytechnic Institute, Auburn; University of Cincinnati, Cincinnati, O.; University of Illinois, Champaign; University of Michigan, Ann Arbor; University of Minnesota, Minneapolis; Kansas Agricultural College, Manhattan; University of Kansas, Lawrence; University of Nebraska, Lincoln; Colorado School of Mines, Golden; University of California, Berkeley.

(383) A. B., Watsonville, ——, writes: Please inform me if J. G. A. Meyer's writings, as published in your columns, have ever been published in book form. If not, I would like to select some of your papers containing them. *A.*—The articles on "Modern Locomotive Construction" have been published in book form by John Wiley & Sons, 53 East Tenth street, New York City. The articles on "Practical Drawing" are being revised and prepared for publication in book form. A set of 92 papers containing the articles on drawing can be sent from this office by mail to any address in the United States, Canada or Mexico for $5 postpaid. We cannot furnish single numbers.

(384) H. C. P., Waltham, Mass., writes: I wish to secure a brazing material, something with which two pieces of steel may be brazed together, then polished and blued, representing one piece of steel. Can you tell me how it is made? *A.*—Solder for brazing steel is made as follows: Take 19 parts, by weight, fine silver, 1 part copper, and 2 parts brass, and melt them under a coat of charcoal dust. This solder is comparatively white in appearance, and renders the seams less observable, but we are inclined to believe that the joint will show to some extent after the steel is polished and blued; much will depend on the preparation and manipulation of the material during the process of brazing. Probably the best method for your purpose is to join the pieces of steel by electricity.

(385) C. B., Brooklyn, N. Y., writes: Kindly answer the following question to settle a dispute: A. says that if, by some suitable arrangement, air be passed over the top of a tube or pipe 17 feet long and 17 feet above the surface of a body of water in a tank, the friction produced between the jet of air and the air in the tube would cause a vacuum to be formed in the tube, and lift the water to the top of the tube, and with a suitable arrangement discharge it. B. says it will not do so. *A.*—If the tube is sufficiently submerged there will be a tendency to form a partial vacuum, but we do not believe it will be sufficient to raise the water through a distance of 17 feet, or anywhere near that distance. 2. What will be the efficiency of a device suitable for this purpose? *A.*—That will depend on the design of the device.

(386) F. W. B., Holbrook, Mass., asks: What is the size of Patent Office drawings? *A.*—10x15 inches. 2. Are these drawings mechanical drawings or perspective drawings? *A.*—They can be made in either form, whichever will show the invention the clearest. 3. Where can I get rules for making isometrical drawings? *A.*—"Mechanical Drawing," by C. W. MacCord, published by John Wiley & Sons, 53 East Tenth street, New York City, contains instructions in isometrical drawing. 4. What is meant by the third angle of projection in mechanical drawing, and is it generally used? *A.*—See answer to Question 315 in our issue of July 5th, current volume. 5. Where can I find the decimal equivalents for standard screw gauges? You can refer me to any of the last 10 volumes of the AMERICAN MACHINIST as I have them all. *A.*—See our issue of August 18, 1888.

(387) W. G. J., Chattanooga, Tenn., writes: I have charge of a 12x36 inch Corliss engine. There is a dispute between myself and the superintendent in regard to the way the engine is running. I set the valves myself, gave the steam valve $\frac{1}{4}$ inch lap, and the exhaust valve $\frac{1}{32}$ inch opening. The engine works nice, but when the load is put on she will work full stroke for two revolutions and then commence to cut off as before the load was put on. The superintendent claims that the engine should not work full stroke at all. I claim that putting on the load suddenly is the cause of the engine working that way. Am I right? *A.*—You are right. 2. The steam pipe is 4 inches diameter and 500 feet from boiler to engine. The pipe has six elbows, and is covered. About what is the pressure of the steam at the engine end, when at boiler end the pressure is 60 pounds? *A.*—Probably 55 pounds.

(388) E. H., Brooklyn, N. Y., writes: Kindly answer the following questions: Is there any rule followed in steam building for determining the length of the connecting rod with reference to the stroke? Which are the ratios commonly met with in practice? And is there a certain ratio predominant? *A.*—The length of the connecting rod depends much on the design and duty of the engine. For large stationary engines the length of the connecting rod is $2\frac{1}{2}$ to 3 times the stroke of the piston when it is practical to afford the space; on smaller engines this ratio is sometimes reduced. In marine engine practice the length should be, if possible, not less than twice the stroke. Those of the horizontal direct-acting engines on warships can seldom be as long as this, they are generally $1\frac{1}{2}$ times the stroke; those of return connecting rod engines are never less than twice the stroke, and sometimes as much as $2\frac{1}{2}$ times; those on trunk engines 2 to 3 times the stroke.

(389) D. W., Indianapolis, Ind., writes: Kindly settle a dispute by informing me whether a perspective view of a ball should be round or not. A.—That depends on the relative positions of the sphere, picture plane, and point of sight. The rays of light coming from different points of an object to the eye are called the visual rays. The points in which the visual rays pierce the picture plane determines the perspective of the object. These visual rays drawn from a sphere to the point of sight form a visual cone, and the curve in which the picture plane intersects this cone will be the perspective of the sphere. The point of sight and the position of the sphere being given, the picture plane may be taken in such a position as to intersect the visual cone in any of the conic sections. If the picture plane is perpendicular to the line joining the point of sight and the center of sphere, the perspective of the sphere will be a circle; when the picture plane is not perpendicular to the line joining the point of sight and the center of the sphere, the perspective will be an ellipse, or it may even be a parabola, or a hyperbola. Since none of the last three curves seem to be the proper representation of a body perfectly round, it has been customary to represent the perspective of a sphere by a circle.

(390) S. M. Y., Cleveland, O., writes: The following has been taken from an English technical journal: "The Admiralty are experimenting with a new form of water tube boiler, designed by a French gentleman named Du Temple, which, it is stated, yields remarkable results. The arrangement of the tubes differs considerably from those in the majority of tubulous boilers. For instance, the tubes are zig zag shape, and of small diameter, those nearest the fire being of less diameter than the others. One of the Du Temple boilers has been fitted in a French torpedo boat, and on the official trial the vessel attained a speed of 27.22 knots. The horse-power developed was 2,700. The grate area is 43 square feet, and heating surface, 1,641 square feet." Is it possible to operate a boiler and produce 2,700 horse power with 43 square feet of grate surface, and 1,641 square feet of heating surface? Usually from 12 to 15 square feet of heating surface is considered to be necessary per horse-power. Kindly explain. *A.*—Assuming that 2 pounds of coal per hour per horse power was used, and we believe that this is a fair estimate, then 5,400 pounds of coal must be burnt per hour, and dividing this by the area in square feet of the grate surface we have, $\frac{5,400}{43} = 125$ pounds of coal burnt per square foot of grate. This is not impossible with a forced draught as was undoubtedly used on this boat; on locomotives this rate of combustion is very common. We should, however, want to see the given figures verified before we can place much confidence in them.

(391) H. B., Elberton, Ga., writes: There is a dispute in regard to a certain point which I would ask you to decide for us. We have two tanks *A* and *B*, to the bottom of each a vertical pipe is attached, but with this difference, the vertical pipe leading into the tank *A* is cut, and a smaller tank *C* interposed, otherwise the connections are precisely the same. The question is, which will throw a greater pressure on the pumps when water is fed through the vertical pipes into the tanks *A* and *B*? If there is any difference, please give the amount. *A.*—The vertical distances from the tanks *A* and *B* to the pumps, and the diameters of the vertical pipes being equal, the pressure on the pumps will be the same in each case. The tank *C* interposed between the sections of the vertical pipe leading into tank *A* will have no influence on the pressure in the pump; of course, it must be here understood that the height of water in both tanks *A* and *B* is the same. The pressure in the pump in each case, neglecting friction and speed, is equal to the weight of a column of water 2 inches diameter, and whose height is equal to the vertical distance from tank to pump. In the beginning, before there is any water in the tanks *A* and *B*, and the pumps running at the same speed, the water will rise faster in the pipe leading to the tank *B*, because the tank *C* connected to *A* must be first filled before water can enter into *A*; under these conditions there will be a difference in the height of the vertical column of water, and consequently there will be a difference of pressure in the pumps. But when the water level is at the same height of both tanks *A* and *B*, there can be no difference in pressure in the pumps.

(392) C. W. H., Brantford, Canada, writes: Kindly inform me of what the lining of a gas furnace is composed. I have some irregular shaped work to heat with the ordinary gas blow pipe, and I thought if I could make forms out of composition similar to that used in a gas furnace, I could heat them much quicker. *A.*—It seems to us that fire clay will answer your purpose. 2. What material should be put in water for hardening tubing, the thickness being No. 24 wire gauge. I have tried dipping in a solution of cyanide of potash and water; it will harden heavy tubing, but not the light kind. *A.*—If the tubing is of soft steel you can case-harden it by melting a mass of cyanide or prussiate of potash, making a red-hot bath of it, in which the tube is heated for any length of time, and when sufficiently heated it should be cooled either in oil or water. Another way to use these materials is to heat the tube in an open fire, and sprinkle it with or dip it in the material, which for this purpose should be in a powdered form. The tube may be cooled as soon as the potash melts, or it may be laid back in the fire to soak, and dipping and soaking repeated until all the benefit possible is derived from the process, after which it must be quickly cooled. The tubes may also be hardened by the regular case hardening process, that is, place the tubes in an iron box and pack them with carbon yielding material, which must be selected for its fitness; it is determined by the quickness of the process and depth of hardening required; charred leather from 1 to 3 hours; fine and then coarser granulated bone as the period increases, from 1 to 24 hours; and hardwood charcoal for longer periods, with mixtures of these for any gradations wanted. The whole is then heated in the usual way, as described in our issues of May 22 and June 5, 1890.

Business Specials

Transient Advertisements 50 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue.

Cleveland, Cleveland, Cleveland, Grant, p. 12.

Forming Lathes, Mer. Mach. Tool Co., Meriden, Ct.

Milling Machs. Kempsmith Co., Milwaukee, Wis.

Turret Drills, 6 spindles. A. D. Quint, Hartford, Ct.

"National" Lathe Chucks. Best made, page 15.

Pattern and Brand Letters. A variety of sizes and styles. Heber Wells, 157 William St., N. Y.

Selden Packing for stuffing box, with or without rubber core. Randolph Brandt, 38 Cortlandt St., N.Y.

Best Presses and Dies for all sheet metal work. Ferracute Machine Company, Bridgeton, N. J.

Air Compressors for every possible duty. Clayton Air Compressor Works, 26 Cortlandt street, N. Y.

Guild & Garrison, Brooklyn, N. Y., manufacture steam pumps, vacuum pumps, vacuum apparatus, air pumps, acid blowers, filter press pumps, etc.

Split Pulleys at low prices, and of same strength and appearance as Whole Pulleys. Yocum & Son's Shafting Works, Drinker St., Philadelphia, Pa.

Improved Duplex and Special Gear Cutters in stock and to order; Gear and Milling Cutters of all descriptions. R. M. Clough, Tolland, Conn.

"Pumping Machinery." New book, 450 pp. 8vo, 270 Eng. Prospectus free. W. M. Barr, 3223 Powelton avenue, Philadelphia, Pa.

Model Locomotives. Complete sets castings N. Y. Central Standard up to date. Rough or finished. G. H. Olney, 163 Herkimer St., B'klyn., N. Y.

New Jersey Art Metal Co., Passaic, N. J., finest thin and ornamental castings in brass, bronze, aluminum, etc.; machinery name plates in brass and aluminum.

Grinders' Supplies—Emery, emery wheels, grinding machines, knife powders and sharpeners, paste and liquid polish, whetstones, etc., etc.; quick process and large stock. Customers annoyed by the delays due to long processes and small stock can get goods in a hurry by buying of The Tanite Co., N.Y. City, Cincinnati, O., and Stroudsburg, Pa.

"Binders" for the AMERICAN MACHINIST. Two styles, the "Common Sense," as heretofore sold by us and mailed to any address at $1.00 each, and the "New Handy," mailed at 50c. each. The former has stiff board covers, while the latter has flexible covers with full page opening flat. Either will hold the entire 52 issues of any volume. AMERICAN MACHINIST PUBLISHING CO., 203 Broadway, New York.

"Indicator Practice and Steam Engine Economy." By F. F. Hemenway. Contains plain directions for using the indicator and making all required calculations from the diagram, also the principles of economy in operating steam engines and current practice in testing engines and boilers. Price, $2 post paid. Published by John Wiley & Sons, 53 East Tenth street, New York.

"Modern Locomotive Construction." By J. G. A. Meyer. In this book the design and construction of all details of the locomotive and tender are considered from a practical standpoint. It contains illustrations of details made from working drawings, accompanied by plain directions for designing, and rules and tables for construction. Adapted to office and shop use. Price, $10. Published by John Wiley & Sons, 53 East Tenth street, New York.

Blowing Engines.—II.

Fig. 7 shows an arrangement of our valve gear on a tub, 84 inch diameter by 60 inch stroke, to work vertically, built for blast furnace work. This gear shows the outlet valve as opened with the pressure from the tub and closed by a cam. The Southwark Foundry and Machine Company has gears, which are not shown here, where the outlet valve is operated with air from the tub in one direction and from the receiver in the other. The inlet valve in each case is positive.

Figs. 8, 9, 10 and 11 show cards taken from a Bessemer engine, operated by air

both ways, now running upon the Bessemer plant at the Homestead Steel Works of the Carnegie Steel Company, Limited. These cards were taken by Messrs. Daniel Ashworth and P. J. Fickinger, mechanical engineers and experts, of Pittsburgh, retained by the Carnegie Steel Company to look after the economical working of their engines and boiler plants.

I have no hesitancy in saying that enough has been done in the direction of high-speed automatic air ends for blowing engines to assure engineers that they are a success, and that at no distant day the old-fashioned mushroom valve will be a thing of the past. There have been the usual difficulties and anxieties in reaching the present state of the art; but we now have no doubt as to the practicability of running the air end of blowing engines as fast as it is advisable to run the steam end.

The improvements shown in these illustrations are so novel as to have made it possible for the inventors to obtain patents with practically no references by the Patent Office.

As to blowing engines, the writer hopes to see the day when the vertical engine, driven from the fly-wheels, will also be a thing of the past, as the crosshead of necessity becomes a long beam. This engine is commonly used because of the small amount of room occupied in its installation, and the seeming lower price. I say "seeming," because in my opinion an engine of this class in five years' time costs any one using it much more than a quarter crank, either horizontal or vertical, after the interest on extra cost for building and ground is added, owing to the increased cost for maintenance and repairs. The breakage of a crosshead in the first mentioned engine sometimes leads to a very large expense, as there is a possibility of the destruction of the most expensive parts of the engine.

David Baker, Sparrow's Point, Md.: The question of the best type of blowing engine is of vital importance to the blast furnace manager, and should be thoroughly discussed. There is room also for discussion on another point, namely, the steam valve setting best suited for either or all types. By more careful attention to this point many costly break-downs might be avoided.

In many engine rooms the indicator is unused, and if the engineer keeps the air valves in fairly good condition, he thinks that, together with the general care of the engine, is sufficient. This is true mostly at small furnace plants.

The experience of the Maryland Steel Company in this matter may be interesting and helpful. The blowing engines used at this plant are of the double-vertical condensing type, the cylinders being 44 by 60 by 84 inches, and fitted with piston steam and exhaust valves. The steam valves are controlled by the Allen link adjustable cut-off. The air valves are of the regular poppet type, 7 inches in diameter, and were originally provided with leather faces.

These engines were built by the Southwark Foundry and Machine Company, of Philadelphia, from designs furnished by the Maryland Steel Company. In their construction no metal was spared to make a very rigid vertical engine, a result which has been realized in their working.

The Bessemer blowing engines in the same house are from the same patterns as the furnace engines, differing only in the size of the cylinders, tie rods, piston rods, and foundation bolts, the cylinders measuring 54 inches instead of 44 inches. The exhaust valves in these engines were set to close when the piston was 10 inches from the end of the stroke, and could be set at no nearer point.

When the engines were erected the steam valves were set with $\frac{1}{16}$-inch lead. This was sufficient to make the compression in the cylinders very high, so that the work of compressing the air was doubled at the end of the stroke, by the compression in the steam cylinder.

After a while this doubled load at each end of the stroke began to tell on the engine. The first trouble was a broken crank, and then beam cap bolts began to break. At the same time we noticed that the bed-plate under the main shaft bearings was lifting. We broke main cap bolts, and finally a foundation bolt in the bed plate near the main shaft bearing. After repairing, and before starting the engine again, the steam valves were set to give some lap. The change in valve settings showed its effect at once. We had no further trouble with the caps or with the lifting of the bed plate. A similar change in the No. 2 engine produced the same result, and prevented any damage to bed-plate or foundation bolts.

The amount of lap which we have settled upon as giving the best results is $\frac{1}{16}$ inch. When running the engine condensing, this gives practically no compression above atmospheric pressure, and at the same time gives an economical card, considering the increased life of the engine.

On the furnace engines we have given the steam valves about $\frac{1}{32}$-inch lap; as the exhaust valves in these engines close when the piston is 3 inches from the end of the stroke. The furnace engines run more smoothly, and there is not so much trouble in keeping the engine from knocking.

Mr. Kennedy speaks of the vexation due to the use of leather, gum, and such short-lived materials for valves. We experienced that, especially with the discharge valves of the Bessemer blowing engines. After trying a number of different compounds for the faces of the discharge valves, we decided upon disks made of vulcabeston as giving the best results.

This material, which is manufactured by the H. W. Johns Manufacturing Company, New York City, is made of asbestos and rubber, vulcanized and pressed into molds to the shape and thickness desired.

We used disks $\frac{5}{8}$ inch in thickness, and pressed to such a density as to be easily drilled with an ordinary power twist drill. The first of these disks has been in use over a year, and shows about $\frac{1}{16}$-inch wear; the leather ones lasted two weeks.

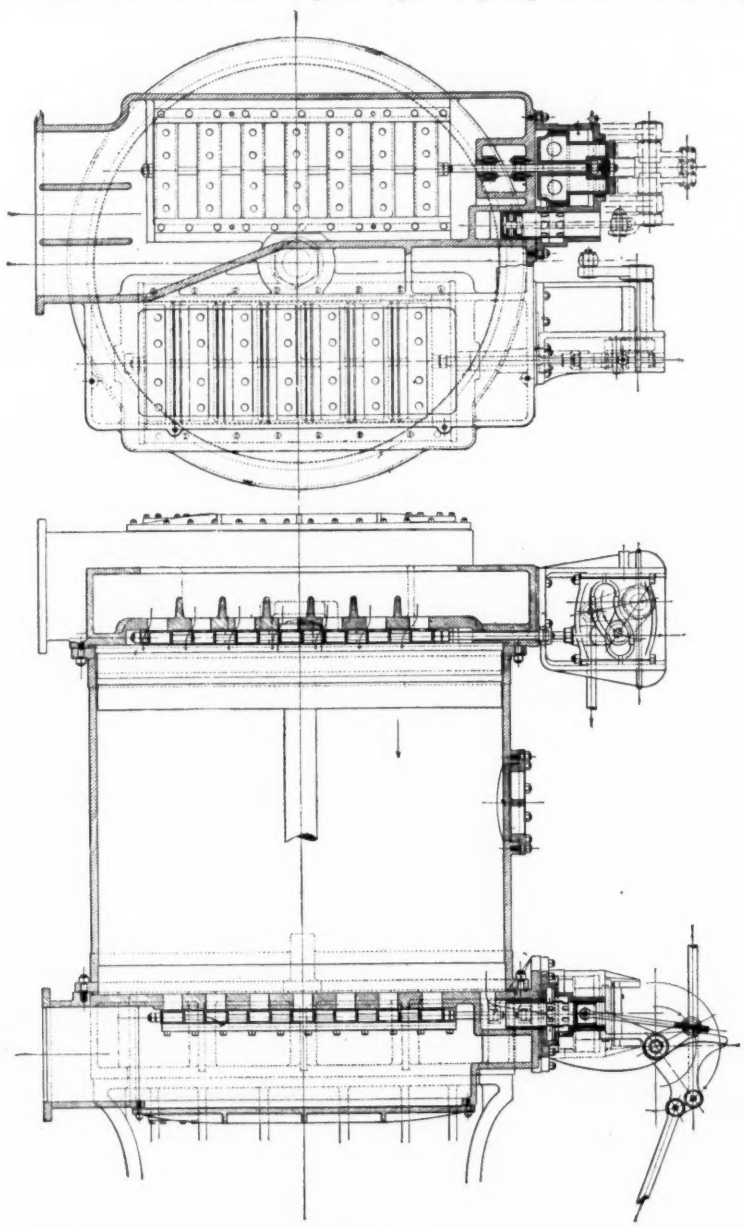


Fig. 7.

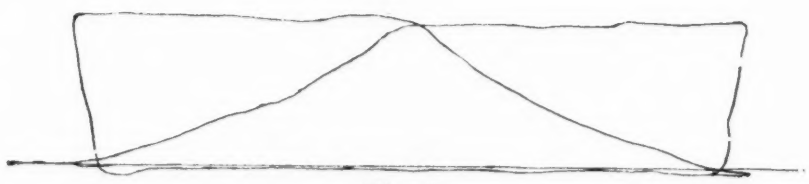


Fig. 8.

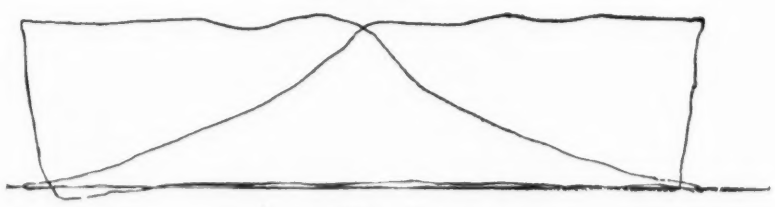


Fig. 9.

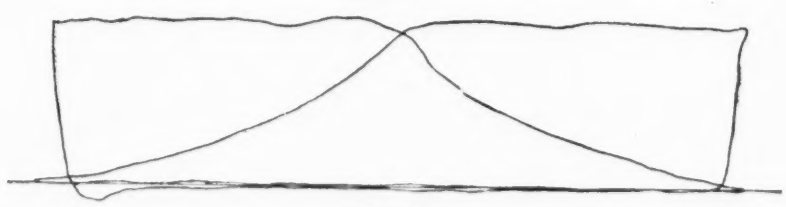


Fig. 10.

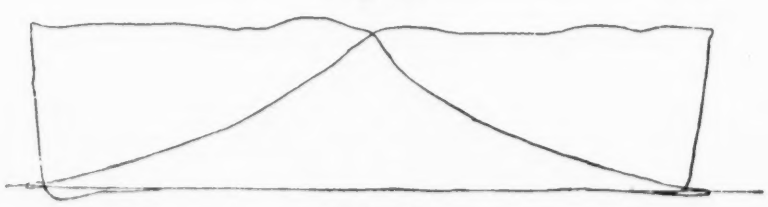


Fig. 11.

Doings at Backaway.

Mr. Editor:

Some time ago I wrote you about putting in the new compound. When the man who came to erect the engine was through with his work, he left, remarking that the company's expert would probably be around in about six months, to see how she was turning over. The engine run as smooth as oil for about four months, then I began to notice a little uneasiness on the centers; you couldn't call it a pound; it was a sort of declaration of an intention to pound if it got the chance of a key just a trifle slack. I don't have to tell engineers any more about it. They know all the symptoms of the disease. It went along this way till the expert came to see it. I was disappointed when I saw him. I had read about steam engine experts, but none had ever visited Backaway. I had expected to see a man who parted his hair in the middle, and talked in hieroglyphics. He introduced himself as Blevins, and named his business. Well, then, he was just the commonest kind of a fellow you ever saw. When he put his hand on the connecting rod, and let it sweep around with the stroke of the piston, and looked at the crosshead in a way that made it evident he was observing its position in connection with the swish of the dash pots, I knew he had been right around amongst steam engines before; wouldn't have to look in his pocket-book to find out about that little jar in the connecting rod, Blevins wouldn't. That fact was plain enough before he said a word.

Blevins watched her turn over a few times, then he remarked, "Just a shade nervous on the centers, isn't she?"

We agreed on this. "Suppose," he continued, "we harness on the indicators, and see what kind of lines she makes."

I have a sort of ready reckoner arrangement for this purpose that does not call for stopping, so this was soon done. Blevins glanced at the diagrams. "Well, Oldone," said he, "what do you say to giving her just a shade more lead when you stop at noon?"

I allowed that if that was what was wanted we would do it, of course.

"I don't know," said Blevins, "whether that is what is wanted or not, and never shall till we try. There are lots of young men who would be dead sure one way or the other; I have been at this kind of business for 15 years, and the most valuable thing I have learned about it is not to be certain. Sometimes that little lack of lead will make an engine a bit notional on the centers, and sometimes it will not. Depends a good deal on the engine, I conclude. If you are right at home with the kind of engine you are dealing with, you can generally tell a good deal about the effect of a little more or less lead, or compression, but this is the second engine of the kind our folks ever built, and I have got their notions to learn. One of these book fellows would figure at the weight of this part, and the

velocity of that part, and give you an opinion pretty nearly as likely to be right as the opinion of your superintendent, who wouldn't come to the engine room with me this morning, because, as he said, he didn't know an engine from a water-wheel, and didn't have to. Said he hired an engineer to know about engines, and I must see you."

We gave her a little more lead, and if you shut your eyes you wouldn't know she had any centers; Blevins said we had guessed about right.

Business was rushing in the mill, which had been working on time orders for three months. We had got along without running nights, and could see the way clear through the orders, with about a week to spare, when without warning—which is always the case you know—the jack shaft let go—went in two pieces as easy as could be. There was a defect in the forging that was not visible on the outside. Didn't look as if there was enough good metal to hold together for one revolution.

As you know, Backaway is not in the midst of iron works and forges. The nearest forge is 30 miles away, a little affair started about a year ago by a man named Ormond. I took the train in the morning for the forge, and the first man I saw, standing in the door, was Ormond himself. I stated the trouble, and asked him to put his hammer at work right away on a shaft; must have it on the next train for Backaway.

Ormond was sorry, but he had everything at work on a job for the R. & M. mills, at Newly, and had promised to let nothing interfere with getting the forgings on the earliest train possible for the works.

"But," said I, "you can hammer up our shaft, and they will never be any wiser for it.

"Oldone," said he, "you are talking without sense. If I followed your advice it would be bad for me. I should like to accommodate you, because I want to get what work you have in my line. But I want to get work from a good many others. I have got only a little forge here—a mighty small one—but I am going to have a bigger one, going to have a bigger one because I shall do just as I agree to do every time, without inquiring whether or not any one knows it. I am going to hold the R. & M.'s work, because I do just as I promise them, and I am going to get more work because I hold theirs. Then I will run the roof over part of that vacant lot, and put in more hammers and more furnaces. That is the way I shall get a bigger plant. It is the way others have built up works, and it is the way I am going to build up. If I start in by doing as you ask me to do, I shall never want a larger plant."

"I know," he continued, "the hurry in your case, and I know something about accommodating and being accommodated. My hammer will be through on this job by five o'clock, then we will take right hold of your shaft, work all night, if necessary, and get it on the first train in the morning."

I felt a little ashamed at my proposition. The reasoning of Ormond was conclusive, and the shaft was shipped next morning. I would go to considerable trouble to give him another job, and shall recommend him all I can.

I have not mentioned that Ormond's forge is at Growby, where the blanket mill is. Owens, I knew, was engineer at this mill, though I had not seen him for a good many years. Owens and I worked together once as machinists at the Sheplunket Iron Works, where they employed a rather sounding name and five journeymen. But he was a steam engine man, and had got his job here when they started up, three years before. As I had to wait round till the next morning, I concluded to go over and see him, and Ormond, who had known him when they were both wandering machinists, offered to go with me. We went into his engine room, but he wasn't there. Pretty soon he came rushing in, threw down a 20-inch monkey wrench and a cold chisel, spoke to us absent-minded like, and went to the boiler room with the remark that he must see how his water was.

Something was the matter, sure. This wasn't the same Owens that used to work at the "iron works." Somehow he didn't look right. Pretty soon he came back, talked a few minutes, then let himself out; said he was going to give up the job—was sick and tired of it. "Why," said he, "I have to fire that boiler, look after the engine, and do all the repairs in the mill. I started in when the mill was new by being handy once in a while with the wrench and chisel, and now I am expected to look after the shafting, tighten up every blessed nut that gets loose around the machinery, doctor up the looms when Ignorance lets them go astray, and not a soul to help me. I have been thinking it all over for three months, pretty much night and day, and I'm going to quit. It is too much for human nature. Besides, some day I shall get too much interested around some machine, and the boiler will go up. You see, Snow"—that is the super—"doesn't think I have got anything to do around here any way; just shovel in a little coal, and put the pump on, and let things go themselves. Some day they will go—up—and I don't figure on being here at that time."

Ormond listened to Owens with a good deal of interest, and when he was through said, "Have you spoken to Snow about all this?"

Owens admitted that he hadn't, wouldn't do any good.

"But," said Ormond, "if you haven't brought the matter to his attention, you don't know anything about it. Here you are ready to quit, and have not even stated your case. Oldone and I will stand a watch here—keep the pump going, and an eye to the fire—and you hunt up Snow, and have a talk with him."

After a little persuasion and the prophecy that it was no use, he went. In just 15 minutes he came back. "Well," said he, "I am the biggest fool in this foolish county. I explained the matter to Snow just as you advised; he said running steam engines was out of his line, and it had never occurred to him that there was so much to it. They could not very well spare me around the mill, as I understood the infirmities of the machinery, but they didn't want to kill me with too much work and worry, nor get blown up. What could I suggest? I told him that a bright, young fellow, ambitious to learn, was just what I needed, and he told me to look for one at once. As I turned to go, he remarked, 'You could have had the help you need, a year ago, if you had only mentioned it. You said nothing, and it is not to be supposed that I knew anything about it. I know something about making blankets, but nothing about your business.' I tell you," said Owens, "it was that last shot of Snow's that showed me what a fool I have been. He wasn't loaded for me, but it hit just the same."

There has been a land boom at Backaway since I wrote you last. The Backaway Land Promotion and Manufacturers Assistant Company was organized, with capital stock, $250,000, assets, the Deacon Wilson farm, over beyond the meadow, purchased of the Deacon's heirs for $1,900. Further assets some hand bills, office chairs, desk and the usual officers; progress some red-hot advertising of "unparalleled advantages," etc. Somehow things did not work well. Some of the land was to be given away to start things, and there has been one application by an old German cooper, who proposed to start in business with himself and two sons as workmen, if the company would donate him ten acres of land, and build a spur from the center of his lot to the railroad—about a mile and a half. The company did not accept his proposition, and there is not, as yet, any manufacturing on the departed Deacon's farm. When it is all sold and given away, and a manufacturing city springs up where the Deacon's cows used to roam, I will write you of some of the new enterprises.

Very truly,
Joel Oldone.

Economical Shop Management.

By Fred H. Colvin.

Continuing this subject it may be as well to consider the drawing room next, as that is an important factor in shop management, but too often considered of minor importance, and the old joke of making a machine first, and then drawing it afterward, is too true in many cases. It very often happens that after a new machine has been built there are points which can be improved, and in this case the machine can best be altered as seems best, then the drawings made to conform to it.

But it should be an ironclad rule that no drawings are to be altered or disregarded in the shop, and if anything is found wrong on them the drawing room should be notified and corrections made. The writer knows of one case where both the superintendent and foreman had a regular system of "revising" drawings to suit themselves without saying a word to any one in the drawing room, and then the manager wondered why duplicate work could not be made, the drawing room was censured, and the drawings ridiculed in the shop. It should take no argument to convince any one that this was neither right nor just, and practical experience shows that it is not conducive to good work nor to good feeling all around.

Before launching any new scheme on the shop there should be a consultation of drawing room and shop to see if there are any mechanical difficulties in the way, and to see that everything will work satisfactorily.

But after the drawing goes into the shop there should be no alterations made, *except by the drawing room*, and all drawings and prints should be altered at the same time, so as to avoid mistakes or confusion. After a print is used in the shop, it should be returned to the drawing room or to a proper place, and either kept for the next job or destroyed, if it is too badly mutilated.

The idea is to have no drawing or print in the shop except such as are needed and except such as are known and recorded by the drawing room.

In case the drawing room and shop cannot agree as to the practicability of any device, the manager, or whoever has final voice in such matters, must have the deciding vote, and this must be final, but in no case should the drawing room be subject to shop revision in the matter of drawings, as such action relieves the drawing room of responsibility, and this must in no case be done.

Having decided on some system of drawings, and of keeping them in order and on record, great care should be taken that details agree in different drawings, so as to keep the idea in the shop that the drawings can be depended on; much depends upon this. Having this department in good condition, the shop must be looked after to see that drawings are followed, and that verbal instructions are not depended on in any of the work, as far as sizes are concerned. The writer recalls an instance where verbal orders by the foreman cost the firm about $250, and the bad feature was in his trying to throw the blame on the drawing room.

Had this shop been accustomed to working by drawings entirely, the foreman would not have made the mistake, or, if he did, the men would have consulted the drawing, and the mistake have been avoided. On all work, where it is practical, the writer has always favored the "sample system" as being preferable to drawings for small works, although much depends upon the nature of the work, and upon local conditions, and it is not recommended as a universal system, although in certain places it has worked very satisfactorily for the writer, but drawings are necessary in the first place, and should go on record. In this connection it is well to note the desirability, if not absolute necessity, of preserving a copy of all the essential drawings intact in case of fire. This can be very readily done by taking prints of all tracings to be preserved, and having them stored in some vault in another building, preferably at some distance from the shop in question.

When it comes to getting out work systematically, in duplicate and at least cost, there is hardly a rule that will fit all cases, men must grasp the surroundings and plan accordingly, but wherever the place is, it is necessary to have care and thought exercised in the planning; jigs, wherever practical, and in duplicate, if the work demands it, and in making jigs it pays to put a little extra work into them, and finish them up fairly well; not that they will work any better, but that men will take better care of and have more respect for a nicely finished tool than a rough one; at least, most men will. I used to think differently, and advocated as little finish as possible, but my later experience has been that a little pretense at finish pays. Of standard sized taps, drills, reamers, etc., or of much used sizes, it pays to carry a small stock on hand besides what are regularly in use, for men will break taps and drills, and delays occasioned by waiting for new ones, even if ordered by telephone, are expensive. Another source of waste is in having men waiting around the tool room for the man in charge to attend to them, and the time lost in this way is considerable in a big shop. It is much better to have boys go for tools, taking the men's checks to deposit for them, and have them on hand by the time the men are ready for them. This would not only save time for the men but would teach the boys the different tools, their names, what they were used for, and how they should be ground, for, of course, they should be ground in the tool room. This keeps the lathes and other tools at work more constantly, making a more even load and a more economical one for the engine of the shop, besides increasing the earning capacity of the tools in question.

Nor is this plan any harder on the men than going after tools themselves, unless it be termed a recreation, and where a man is paid by the piece it is not recreation in shop hours that he is after, but rather as few delays as possible.

The writer has no desire to make the workman's lot any harder, but rather to make his time in the shop more effective, tending to shorter hours rather than to harder work. In addition to this it pays, in a large shop, to have separate tool rooms for the different departments, and each tool room equipped with tools for that department and grinding apparatus, but the repairing and tool work can best be done in one central place, the grinding, however, can be done in each room.

The question of the proper relation between superintendents and foremen is worthy some thought, for we too often find a lack of harmony which is not only disagreeable but also positively costly to the operating expenses of the shop.

The conflict of authority which we see too often, which generally assumes the form of having the superintendent interfere with a man who is on some particular job, which was given him by his foreman, and put him at something else without notifying the foreman of his intention, costs. And can we wonder that the foreman is not in the best frame of mind when he finds out what has been done? Or wonder that he does not feel the incentive to look after his department to the best of his ability, when his plans for getting out work at reduced cost are upset, without consultation, and his authority put to one side in the eyes of his men?

In the great majority of cases there is no excuse for the superintendent dealing with anyone but his foremen, and when this is done the efficiency of the shop will be at its best if general plans are laid right. Of course, any suggestion as to management of the department that he wishes to make to the foreman is perfectly within his bounds, but the foreman should have the carrying out of the plan outlined, and if for any reason

he does not carry out his chief's plan, another foreman is in order.

But as long as you retain a man do not cripple his authority by stepping in when there is no cause, and thereby lowering his authority in the eyes of the men, as it makes it so much harder for the foreman to get along than before this is done.

There is a feature which has crept into one or two hitherto well organized and economically operated shops, which consists essentially of not aiming to make the expense of erecting or "setting up" machinery as low as possible, and too many seem to forget any expense after the machine leaves the shop, when in most instances this is by no means the end of it. The writer knows of several instances where men have been kept out on "setting up" jobs for nearly a year, not on account of work particularly, but because the machine they have erected has to have careful nursing in order to make it run at all, and the hope is that by keeping a man there it may finally be accepted. Then the work that has to be done is of a most expensive character, as it must usually be hand work, and in too many instances the shop foreman will leave all the work possible for the outside men in order to avoid responsibility for fittings that must come in line. There is also much work that might be done in the shop that is left for the outside man, not from intention but from lack of forethought on the subject. This matter of keeping men on outside work is expensive, and when it counts up into weeks and months it is something enormous, and eats into the profits in an astonishing degree.

This is one of the leaks that should be well looked after, for it is all the more dangerous from not being realized by many. In too many cases the cost of manufacture is based on the actual cost of the machines, and then this deducted from the selling price, and surprise is manifested when the total profits of the year do not accord with these figures. The expense must be calculated until the machine is delivered and paid for, as it does not end when it leaves the shop.

N. A. S. E. Meeting.

The 13th annual convention of the National Association of Stationary Engineers, will be opened at Hazazer's Hall, Baltimore, Md , on Tuesday morning, September 4th. The session will continue for four days. Delegates will be welcomed by the Governor of Maryland, and the Mayor of Baltimore.

The delegates from New England, New York and New Jersey, will leave Jersey City on Sunday, September 2d, at 1.30 P. M. Private parlor cars will be provided.

A meeting of the delegates of New York City and vicinity, will be held on Sunday, August 26th, at the southeast corner of Forty ninth street and Third avenue, New York.

The Committee on Transportation have succeeded in getting special rates of one and a third fares for the trip. Further information can be obtained of M. D. Naegle, Chief Engineer, Murray Hill Hotel, New York City.

The National Railroad Master Blacksmiths' Association hand us the following. The secretary's address is Gladstone, Minn :

Editor American Machinist :

Dear Sir.—The next annual convention of the N. R. R. M. B A. will open in Pittsburgh, Pa , on Tuesday, September 4th, and the sessions will continue Wednesday and Thursday. The indications are that the meeting will be exceptionally well attended, and present many features of mechanical and social interest. Thus far there have been planned visits and tours of inspection to the various works in and about Pittsburgh. Among the papers contributed several give promise of unusual interest.

The Home Hotel, Dusquesne Way, between Eighth and Ninth streets, has been designated as the official headquarters during the session.

J. J. Thornton, *Pres.*
G. F. Hinkens, *Sec.*

It is announced that David W. Pond, President of the Pond Machine Tool Co., Plainfield, N J , has sold out his interest in that concern to E. S Maxwell, of Manning, Maxwell & Moore. Mr. Maxwell succeeds Mr. Pond as president of the company.

Manufactures.

W. P. Coffman, of Tipton, Tenn., will locate a stave factory at Pine Bluff, Ark.

The Pond & Decker Lumber Company will erect a saw-mill plant at Gilmore, Ark.

The White River Paper Co., of White River Junction, Vt., is erecting a new building.

New machinery has been added to the equipment of the pulp-mill at Lincoln, Me.

Two new engine houses are to be erected at Hartford, Conn., at a cost of $52,000.

The Bonnie May Mining Co. has been organized in Hartford, Conn. The capital is $15,000.

Marsh & Shepardson, a recently formed firm at Attleboro, Mass., is to manufacture jewelry.

The Jenkins & Bogart Mfg. Co., Kingsfield, Me., have made arrangements for building a new mill.

The Viaduct Manufacturing Company will at once rebuild its burned electric plant at Baltimore, Md.

The Geo. H. Friend Paper Co., West Carrollton, O., will arrange to make wall paper in its paper mill.

The Perkins Electric Switch Manufacturing Co., Hartford, Conn., is to increase the size of its factory.

Plans are underway at Madison, Ga., for the establishment of a knitting mill. Captain Becker is interested.

J. Hooper and others have incorporated the Roessle (Tex.) Manufacturing Co. with a capital stock of $10,000.

The Coffin Valve Company has been organized at Kittery, Me., with $50,000 capital; president, Zebulon E. Coffin.

The Keyser Electric Co. has been formed at Keyser, W. Va., and will erect a plant at once, capital stock $50 000

Bath, Me., is to have a new brass foundry, started by Hon. F. B. Torrey, former proprietor of the Torrey Bushing Works.

The cotton-mill at Davidson, N. C., will put in carding machinery, and contemplates putting in more looms and spindles.

A syndicate will erect a cotton-mill in Waco, Tex., if sufficient inducements are offered. J. Hansel Wood is interested.

A stock company, capitalized at $150,000, has been incorporated, to manufacture iron-working machinery at Lowell, Mass.

The Great Works pulp mills and saw mills, at Oldtown, Me , will resume work shortly, giving employment to over 250 men.

Parties will erect a wood pulp paper mill of about six tons daily capacity at Sparta, Tenn , and forty hands will be employed.

The Nashua (N. H.) Mfg. Co is to make improvements in its motive power. A new water wheel is to be put in at the No. 1 mill.

The Universal Electric Messenger Call Co. has been formed at Portland, Me., for the purpose of manufacturing appliances with $100,000 capital.

H. S. Cummings, in behalf of a syndicate of capitalists, has purchased at Washington, D. C., a tract of land upon which will be erected an electric plant.

It is said that the Viaduct Manufacturing Co., whose plant was burned at Relay, Baltimore, Md., has made arrangements to resume operations at once.

The Common Sense Egg Carrier Company has been incorporated to manufacture egg crates in Mentz, N. Y. Capital $10,000. G. M. Miles is connected.

WATER REDUCING VALVE

for use in reducing water pressure in street mains for domestic service. Simple and reliable.

MASON REGULATOR CO., BOSTON, MASS.

Buffalo FAN SYSTEM OF HEATING & VENTILATING ALL LARGE BUILDINGS · BUFFALO FORGE CO · BUFFALO, N.Y. BY A FORCED CIRCULATION OF WARM AIR. CHICAGO OFFICE, 22 W. RANDOLPH ST.

GRANT GEARS

CLEVELAND 86 SENECA ST., Near Union Depot. NEW GEAR SHOP. GEO. B. GRANT.

MECHANICAL DRAWING.
By Prof. CHAS. WM. MacCORD.
Part I.—Progressive Exercises.
Part II.—Hints to Draftsmen.
4to, cloth.....$4.00
JOHN WILEY & SONS, NEW YORK.

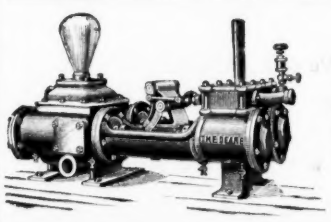
American Standard Gauge & Tool Works, WILMINGTON, DEL.
Adjustable SHELL REAMERS
⅝ inch to 5 inch.
JAMES A. TAYLOR & CO.
Send for New Pamphlet.

EDISON-LELANDE BATTERY.
Invented by the Chemist Lelande of Paris and improved by Edison.
Most constant of all primary batteries.
60,000 IN USE.
ADDRESS:
EDISON MFG. CO., 110 East 23d St., N. Y.

SECOND-HAND MACHINE TOOLS
FOR SALE AT LOW PRICES.

50 Driving Wheel Lathe. N. Y. S. E. Co.'s make. Fair order.
30″x30″x10′ Harrington Planer. Good order.
20′x20′x6′ Pratt & Whitney. Good order.
34″x8½′ Putnam Engine Lathe, rod feed, screw and compound rest. Good order.
26″x8′ Pratt & Whitney Chucking Machine. Very good order.
12″x4′ Pratt & Whitney Engine Lathe, with taper attachment.
1 Pratt & Whitney "Grant Pattern" Double Column, Double Head Milling Machine. Good as new.
2 22″ Pratt & Whitney Manufacturers' Drills, with two-spindle attachment. Good order.

E. P. BULLARD, 145 Broadway (Room 6), New York.
BRIDGEPORT MACHINE TOOL WORKS, BRIDGEPORT, CONN.



THE DEANE OF HOLYOKE **STEAM PUMPS**
DEANE STEAM PUMP CO., HOLYOKE, MASS.

CRESCENT STEEL
ESTABLISHED 1865 ✻ INCORPORATED 1889.
CRESCENT STEEL CO.
480 PEARL ST. NEW YORK — PITTSBURGH, PA. — 64 & 66 S. CLINTON ST. CHICAGO.

"LIGHTNING" SCREW PLATES IN **Birmingham ("Stubs") Wire Gauge Sizes,**
SCREW GAUGE SIZES AND SIZES IN FRACTIONAL PARTS OF AN INCH.
For BICYCLE REPAIRERS, ELECTRICIANS and others.
Adjustable Dies with Case-hardened Guides.
Send for Supplement No. 1.
WILEY & RUSSELL MFG. CO., GREENFIELD, MASS., U. S. A.

"R. MUSHET'S SPECIAL STEEL"
SAVES LABOR in being able to run at GREATLY INCREASED SPEEDS. FEWER GRINDINGS. No WASTE in redressing.
Sole Representatives in the United States.
B. M. JONES & CO.,
BOSTON: 11 & 13 Oliver St., NEW YORK: 143 Liberty St.

Speaking of LATHES!
We are building them in various sizes from 10 inch to 24 inch swing, in various lengths, both engine and speed lathes. Our designs are the latest and most approved, while the workmanship, material and finish are of the highest order. Our catalogue will tell you all about them, as well as of our planers, shapers, drills and other tools and supplies. A postal will bring it. Write us for prices.
SEBASTIAN LATHE CO.,
117-119 CULVERT ST., CINCINNATI, OHIO.

ASBESTOS
SMOKE STACK PAINT
Used on the ships of the U.S. Navy and by the prominent Steamboat and Transportation Companies. The only paint supplied in colors which has given absolute satisfaction where forced draught is used.
READY FOR USE. ALL ORDINARY SHADES.
H. W. JOHNS M'F'G CO. 87 MAIDEN LANE, NEW YORK.
NEW YORK JERSEY CITY CHICAGO PHILADELPHIA BOSTON LONDON

The Tanite Company, Stroudsburg, Pa., has issued a neat and quite complete catalogue of emery grinding machinery, which will be sent free on application.

The Berlin Iron Bridge Co., of East Berlin, Conn., are furnishing the iron roof for the new boiler and dynamo room for the Larchmont Electric Co., at Mamaroneck, N. Y.

The Grinnell Fire Extinguishing Company, Providence, has purchased a large piece of land in the city, and will at once commence the erection of a $160,000 block.

The new Lincoln Foundry and Machine Co., of Pittsburgh, Pa., is to erect a new machine shop in connection with its foundry, the dimensions of which are to be 110x100.

The McMillan Machine Co. has been organized to manufacture type setting machinery at Ilion, N. H., capital $100,000, and directors, J. B. Vanduesen and others.

The Flexible Sole Machine Co. has been organized at Kittery, Me., with $50,000 capital. The officers are: President, Thos. W. Hough; treasurer, George H. Millan, Jr.

The Eagle Pencil Co., of New York, will erect a factory in South Pittsburg, Tenn. The main structure is to be 40x180 feet, two stories. This plant will employ 150 to 200 hands.

There has been formed the Dobbie, Stuart & Co., of Niagara Falls, N. Y., to manufacture machinery. Capital $28,000, and directors, J. Dobbie, A. R. Gow and W. S. McIntyre, A. J. Dobbie and J. Stuart.

F. W. Otis, who removed his machine shop from Ansonia, Conn., to Tyler City, several months ago, has decided that there is no place like Ansonia, and has leased the room he occupied for several years in Gardner's block, and has gone to work again.

Twenty-five hundred men went to work at the Illinois Steel Company's plant on July 30th. The works had been closed down since the strike began. One thousand more workmen will be given employment by the company before the end of the week.

The Geo. W. Helme Co., at Helmetta, N. J., have placed the contract for their new roasting house with the Berlin Iron Bridge Co., of East Berlin, Conn. The roof will be covered with the Berlin Company's patent anti-condensation corrugated iron roof covering.

The Northwestern Elevator Company, for elevating and storing grain and for storing merchandise and other property in Oswego, capital $60,000, and directors Theodore Erwin, George B. Sloan, Robert Downey and Dudley M Irwin, of Oswego, has been incorporated.

The Baackes' Wire Nail Works, the largest concern of the kind in the country, which has been idle for several months, has resumed work with a big force of men. Within a few days it is proposed to put on a night and day force, and run the plant double time in all departments.

It is understood that the Johnson Steel Company, of Loraine, Ohio, has entered into a contract with a company to erect a tin plate factory. It will be a very large concern, and will, it is said, employ 1,000 men. The tin sheets will be furnished the new concern by the Johnson Company.

The New Hartford Water Company has completed plans and specifications for the system of water-works to be built in that city. The company has secured possession of three valuable water courses, commonly known as the Mulligan, the Condon and the McLoughlin streams.

The James Leffel & Co., of Springfield, Ohio, has issued a fine and complete new pamphlet, illustrating and describing their well-known line of upright and horizontal steam engines, and steel boilers with latest improvements. A copy may be had free on application to the company.

The Lodge & Davis Machine Tool Co., of Cincinnati, O., have made shipment to Arequipa, Peru, and Santiago, Chile, on orders received from their salesman, who is now traveling in South America. They have also just made shipment of one of their large engine lathes to the port of Odessa, Russia.

The Morgan Engineering Works, Alliance, Ohio, have on their books at present orders for a large number of electric cranes, showing, it would appear, that business is not very slack in this department of their works, as well as that manufacturers are buying to some extent. The Morgan Works have, we believe, furnished 22 cranes to one concern.

Manning, Maxwell & Moore, 111 Liberty street, New York, have recently booked a number of orders for the Shaw three-motor electric traveling crane, and say: It is evident in these times of depression that the economy of handling material is a great factor, and the leading manufacturing establishments are availing themselves of the most modern methods of handling work by mechanical devices, and are putting in the very latest improvements in the way of labor saving machinery.

The Farrel Foundry and Machine Co., Ansonia, Conn., purposes to erect a new building of brick with iron roof to which will be transferred the heavy chilled roll department. The site is between the railroad tracks and the new foundry, and the dimensions of the building, about 250 feet long by 100 feet wide, will occupy the company's land to the northern boundary. It is expected to begin construction immediately. To make room for the new building to be used by the heavy roll department, the Farrel Foundry and Machine Co. will have to tear down what for years has been known as the "old cooper shop."

The Sperl Heater Co., of Carbondale, Pa., has broken ground for a machine shop in that city, for the manufacture of the "Sperl" patent steam and hot water heater. This plant was removed from Susquehanna, Pa., and was formerly known as the Susquehanna Steam Heater and Manufacturing Co. The Carbondale Board of Trade furnished $20,000 to the company, which is capitalized at $30,000. Pending the construction of its shops, the Sperl Heater Co. is building quite a number of heaters on orders in the shops of Van Bergen & Co., Ltd., Carbondale. C. E. Rettew is president; A. D. Harding, secretary; A. P. Trautwein, treasurer, and Thomas McDonald, manager. A complete machine shop outfit will be purchased at once.

For several weeks it has been rumored that the Waterman Machine Tool Co., George V. Rogers, president and treasurer, had purchased the shops and business in Oakland, Me., known as the Oakland Machine Co. It is understood that this is a modern plant throughout, and was built by Dustin & Hubbard about six or seven years ago. During the past few years the Waterman Machine Tool Co. have introduced many new tools, particularly in the line of boring and drilling machines. Their tools are well and favorably known all over the country, and much of their product has gone abroad. The last year has been a busy one for this company, and the business year ending July 12, 1894, it is stated, shows the most profitable results in its history, and it is the lack of room with suitable facilities for handling their product that induced them to locate in Maine, where the factory, which is in full running order, was quickly available, without seriously holding back their orders. This company, which recently purchased the H. C. Pease iron planer business, formerly of

"Star" Foot Lathe Swings 9x25 in.

LATHE

Screw Cutting Automatic Cross Feed, etc.

Scroll Saws, Circular Saws, Lathes Mortisers.

Catalogue Free of all our Machinery.

Seneca Falls Mfg. Co., 687 Water St., Seneca Falls, N.Y.

C. W. LE COUNT,
SOUTH NORWALK, CONN.

REDUCED PRICE OF LE COUNT'S HEAVY STEEL DOG

No.	Inch.	Price.
1	3-8	$ .40
2	1-2	.50
3	5-8	.60
4	3-4	.60
5	7-8	.70
6	1	.70
7	1 1-8	.80
8	1 1-4	.80
9	1 3-8	.95
10	1 1-2	.95
11	1 3-4	1.10
12	2	1.20
13	2 1-4	1.35
14	2 1-2	1.45
15	3	1.60
16	3 1-2	1.80
17	4	2.10
18	4 1-2	2.75
19	5	3.25
Full set of 19		$21.60
20 (ext.) 5 1-2		4.00
21 (ext.) 6		5.00

This Dog has a Very Heavy Boss, so that if the thread wears, a larger screw can be substituted.

Le Count's Heavy Steel Dog.
With Steel Screws, Lathe Made and Hardened.
When ordering, state as above, whether a full set or a set of 12, or small set of 8. Users of these dogs prefer them to any other make.

One Small Set of 8—by 1-4 inches to 20 inch, - - $6.25
One Set of 12—by 1-4 in. to 2 in. continued by 1-2 in. to 4 in. 13.25

These goods are for sale by CHAS. CHURCHILL & CO., L'td, 21 Cross St., London, England.

JESSOP'S STEEL

FOR TOOLS, DRILLS, DIES, &c.

ALL KINDS IN STOCK.
Manufactory, SHEFFIELD, ENG.
Chief Am. Office, 91 JOHN ST., N. Y.
WM. JESSOP & SONS, LTD.
Established a century ago.
Medal World's Columbian Exposition 1893.

DON'T ACCEPT ANY SUBSTITUTE FILE.
INSIST ON HAVING
NICHOLSON.

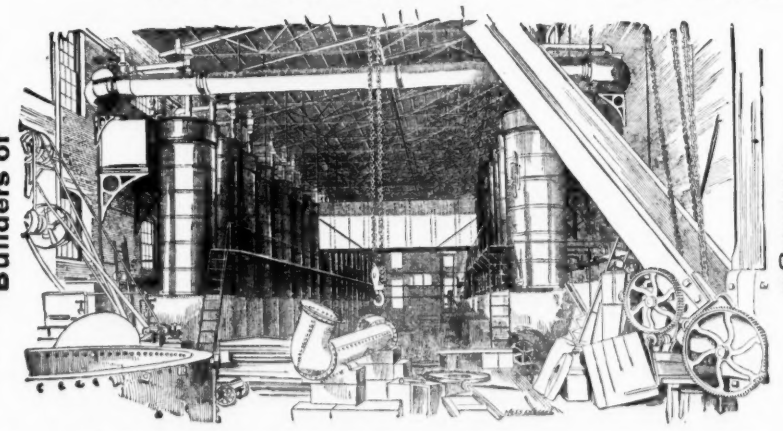
NICHOLSON FILE CO.
PROVIDENCE, R. I., U. S. A.

3000
VARIETIES FILES
[X. F.] & INCREMENT CUT FILES.

THE BERLIN IRON BRIDGE CO.
Office and Works,
No. 8 Railroad Ave., East Berlin, Conn.

CHAS. M. JARVIS, Pres. and Chief Engineer. BURR K. FIELD, Vice-President.
FRANK L. WILCOX, Treasurer. GEO. H. SAGE, Secretary.

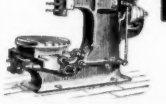
Engineers, Architects and Builders of



Iron and Steel Bridges and Buildings.

The above illustration is taken direct from a photograph, and shows the interior of a Boiler House, the roof of which was designed and built by us for the Amoskeag Mfg. Co., at Manchester, N. H. The building is 75 feet in width by 275 feet in length, the walls being made of brick, and the roof being made of iron—iron trusses, iron purlins—and covered with corrugated iron, so that there is absolutely no woodwork anywhere about the building which can take fire. For boiler rooms this construction particularly commends itself.

SEND FOR OUR ILLUSTRATED CATALOGUE.



BETTS MACHINE COMPANY,

MACHINE TOOL BUILDERS,

WILMINGTON, DEL.

FITCHBURG MACHINE WORKS,

MANUFACTURERS OF

FITCHBURG AND OTHER MODERN

SEND FOR CATALOGUE E.

14-inch Engine Lathe.

THE CELEBRATED

ENGINE LATHE

METAL-WORKING MACHINES

FITCHBURG, MASS.

BUILDERS IRON FOUNDRY,
FOUNDERS AND MACHINISTS,
PROVIDENCE, R. I.

Orders are solicited for machine work requiring accurate workmanship and large machine tools. Our equipment is probably superior to that of any shop in New England, employed chiefly for contracts or general jobbing. Small, as well as large orders receive careful attention, and we are prepared to assist machine shops which have tools smaller than our own.

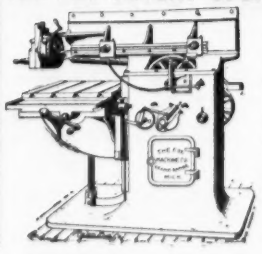
CHATTANOOGA DOUBLE STRENGTH
WOOD SPLIT PULLEYS.
Lighter, Better and Cheaper than Iron.
Oval Bushings, Nailed Segments.

A LARGE STOCK CARRIED BY
COOKE & CO.,
163 & 165 Washington St.,
NEW YORK.
MENTION THIS PAPER.

HENRY CAREY BAIRD & CO.,
INDUSTRIAL PUBLISHERS, BOOKSELLERS AND IMPORTERS,
810 Walnut St., Philadelphia.

☞ Our New and Revised Catalogue of Practical and Scientific Books, 88 pages, 8vo., and our other Catalogues and Circulars, the whole covering every branch of Science applied to the Arts, sent free and free of postage to any one in any part of the world who will furnish his address.

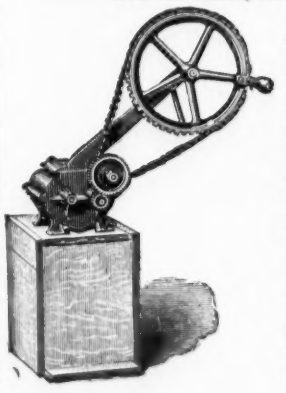
THE FOX PATENT OPEN SIDE SHAPER.



No springing of ram. No overhanging table. Quick Return. Stroke Under Perfect Control. Can be Instantly Adjusted 1 1-6 in. or 24 in. No Screws to Monkey with. Powerful, Quick, Accurate. Write for circular.

The Fox Machine Co.,
325 N. Front St.,
Grand Rapids, Mich.
135 Finsbury Pavement, London, England.

ROOTS' NEW ACME HAND BLOWER.
For Blacksmiths, etc. Slow Speed, Positive Blast. Is Durable, Compact and Cheap; also Portable Forges, Tuyere Irons and Foundry Blowers.



P. H. & F. M. ROOTS, Mfrs.
CONNERSVILLE, IND.
Chicago Office: 1405-10 MANHATTAN BUILDING.
S. S. TOWNSEND, Gen. Agt. } 163 & 165 Washington St., NEW YORK.
COOKE & CO., Selling Agts. }
Please Mention This Paper.

WORTHINGTON CONDENSER.

ONLY APPARATUS that can MAINTAIN a VACUUM on ENGINES and ELEVATE the discharge WATER to TANK at any height.

This feature is appreciated by PAPER MILLS, SUGAR REFINERIES, COTTON and WOOLEN MILLS.

HENRY R. WORTHINGTON,
NEW YORK, 86 and 88 Liberty St.
BOSTON, 70 Kilby St.
PHILADELPHIA, 607 Arch St.
CLEVELAND, 24 South Water St.
CHICAGO, 185 to 189 Van Buren St.
ST. LOUIS, Eighth and St. Charles Sts.

Worcester, Mass., have improved these tools. They will also manufacture the Dexter Machine Co.'s lathes and drills, orders for which can be promptly supplied by the Consolidated Co.

Machinists' Supplies and Iron.

New York, August 11, 1894.

Iron—American Pig—We quote standard brands, $12.50 to $13 for No. 1; $11 to $12 for No. 2. Southern brands, $11 50 to $12.25 for No. 1; $10.50 to $11 for No. 2; $10 to $10 25 for No. 3; $10.50 to $11 for No. 1 soft; and $10.25 to $10.75 for No. 2 soft. Foundry No. 4, $9.75 to $10 25.

Antimony—We quote L. X., 8¾c. to 8¾c.; Cookson's, 9¾c. to 10c.; Hallett's, 8.¼c. to 8.¼c; and U. S. French Star, 10c.

Lard Oil—We quote 55c. to 57c., according to quantity.

Copper—The market is more active, with prices favorable to the buyer. For Lake Copper 9¼c. to 9¼c. Is asked, but large quantities can be bought at 9c. Holders of Casting Copper are more liberal in their offers; it is said that 8½c. has been accepted.

Lead—The market is very unsettled. Spot lead is quoted at 3 50c. to 3.60c., futures at 3.35c. to 3.50c. The demand is very light.

Spelter—The market is weak; 3.40c. is quoted for New York delivery. Buyers are well supplied, and are holding off.

Tin—The market closed steady, with slightly higher prices. For spot 19.10c. is asked, and 19c. is bid.

WANTED

"Situation and Help" Advertisements only inserted under this head. Rate 30 cents a line for each insertion. About seven words make a line. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Machinist wanted in a small shop in Wisconsin. Address, with references, J. R., Am. Machinist.

Mech. draftsman, with exp. and 1st-class refs., wants pos. P. Andersson, 126 W. 50th St., N. Y.

An experienced draftsman and designer wants a position. Box 137. Am. Machinist.

A mech eng. & d'ftsman of 10 yrs pract. exp'nce is open for engagement. Box 139, Am. Machinist.

Wanted—A mech. d'ftsman. P. O. drawer No. 63, New Haven, Ct., stating age, exp. & pay expected.

Mechanical draftsman, technical education, and experience in both drafting room and shop, wants position. Address Box 134, American Machinist.

Wanted—A competent man to take charge of a small but complete plant for manufacturing elevators. Box 129, American Machinist.

A recent technical graduate desires situation as draftsman in some New England concern. Best of refs. and recommendations H. T. G., Am. Mach.

A mechanic with technical education and experience in fitting up for manufacturing, desires a position. Box 138, Am. Machinist.

Good machinist, experienced in superintending of erecting steam power plants, "steam" and "Fan." systems of heating, also a good draftsman, wants position. Earnest, Am. Machinist.

First-class mech. eng. and draftsman, expert in iron and steel works and mining mach'y, in steam, hydraulic and gen. eng'g & structural work, wants responsible pos., moderate terms. Vollhammer, 1024 Park ave., New York.

Wanted—A man thoroughly acquainted with the Jones & Lamson turret lathe; one who can work the machine to its full capacity. To such a man, steady employment can be given. Address Taunton (Mass.) Locomotive Mfg. Co.

Wanted—Foreman of engine and machine department. A live, active young man who has had experience on engine and general machine work. Give age, experience, reference, and salary wanted. Box 260, Buffalo, N. Y.

Position as superintendent or assistant in machine shops is desired. Have had wide exp. in design'g and construct'g isolated and town electric light'g plants. Rope driv'g and econom'l runn'g of large power plants a specialty. A. B. C., Am. Mach.

An expert mech. eng. & d'ftsman, pract. machinist, has wide exp. in drawing room & shop; well qualified to develop new ideas and further employer's interests, is open for position in office or shop. Box 140, American Machinist.

✢ MISCELLANEOUS WANTS ✢

Advertisements will be inserted under this head at 35 cents per line, each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Cheap 2d hd lathes & planers. S.M.York,Clev'd,O.

Auto. Steam Flue Cleaners. Kelley Co., Erie, Pa.

Calipers & Gauges. F. A. Welles, Milwaukee, Wis.

For Sale—Second-hand drill presses, engine lathes & planers. Dietz, Schumacher & Co., Cincinnati, O.

Light and fine machinery to order; Foot Lathe Catalogue for stamp. E. O. Chase, Newark, N. J.

Wanted—To buy good second-hand tools. Box 83, American Machinist.

For Sale—Foundry and machine shop in Florida. Paying business; small capital. Address Mch., American Machinist.

Do you want a picture of the famous Locomotive "999?" Send 50 cents for our fine copper plate *transparent* picture (14x28), showing all parts *inside* and *outside*, all named and numbered, on satin gloss paper, for framing, educational, beautiful, correct. Locomotive Engineering, 256 B'way, N.Y.

Established in 1874.

CLEVELAND TWIST DRILL CO.

COR. LAKE & KIRTLAND STS., CLEVELAND, O.

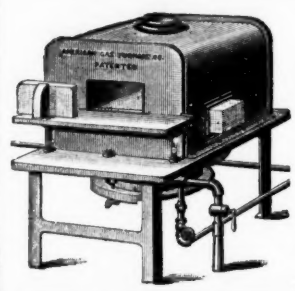
100 & 102 Reade Street, New York.
85 Queen Victoria St., London, Eng.
5 Neue Promenade, Berlin, C., Germany.

DETROIT TWIST DRILL CO., DETROIT, MICH., U. S. A.

SOLE MANUFACTURERS OF

GRAHAM'S GROOVED SHANK TWIST DRILLS AND CHUCKS.

Endorsed by Practical Mechanics Everywhere. Send for Catalogue.



AMERICAN GAS FURNACE CO.,

Oil Gas Plants

GAS BLAST FURNACES AND HIGH PRESSURE BLOWERS

For the economical generation and systematic application of HEAT.

CATALOGUES ON APPLICATION.

No. 80 Nassau St., NEW YORK.

English Agency: Chas. Churchill & Co., Ltd., 21 Cross St., Finsbury, London, E. C., England.

SECOND-HAND MACHINE TOOLS,

Boiler Tools and Steam Hammers

Now remaining unsold in the Engine and Boiler Works, will be sold very low before removal.

IRON PLANERS.

19 in. x 3 ft. Wheeler.
30 " x 6 " Pratt & Whitney.
22 " x 5 " Pease.
24 " x 4 " Wood & Light.
24 " x 5 " New Haven.
26 " x 7 " N. Y. S. Eng. Co.
30 " x 10 " Bancroft.
30 " x 10 " Harrington.
35 " x 7 " Hewes & Phillips.

SHAPERS.

8 in. Stroke Gould.
16 " " Gould & Eber.
22 " " Triple Geared.

DRILLS.

25 in. Swing Prentice, complete.
26 " " Prentice Friction.
40 " " Cinti, complete.
48 " " Old Style.
Radial Drill, 86 in., complete.

MILLING MACHINES.

Brown & Sharpe No. 6, Plain.
Brainerd Plain, Table 30 x 8.
Garvin, Lincoln, latest pattern with Centers, Vice Arbor.

BORING MILLS.

Bement No. 2 Hor., B. & D.
Bement Cyl. Borer, 12 to 36 in.
Upright B. & T. Mill, 38 in.
Pond Upright B. and T. Mill, 6 ft.
B. & S. Upright Turret Borer.

ENGINE LATHES.

13 in. x 6 ft. Blaisdell.
13 " x 4 " P. & W. Taper.
14 " x 6 " Reed.
15 " x 5 " Pond.
16 " x 6 " New Haven.
16 " x 6 " Ames.
18 " x 8 " Putnam.
20 " x 10 " Fitchburg.
22 " x 8 " Harrington.
24 " x 12 " Putnam.
35 " x 15 " Hewes & Phillips.
36 " x 24 " Old Style 'cheap.'
36 " x 17 " Ferris & Miles.
48 " x 17 " Hewes & Phillips.

HAMMERS.

50 lb. Helve, Bradley, Up'g't.
300 " Steam, Ferris & Miles.
800 " " " "
1200 " Drop with Lifter, Farrel F'd'y's Make.

BOILER TOOLS.

Rolls, 6, 8 and 10½ ft.
Hor. Flange Punch, "H. and J."
Flange Clamps, 6 ft.
Bement Plate Planer, 16 ft.

MISCELLANEOUS.

Acme, 3½ in. Bolt Cutter.
Slotters 10 and 18 in. Stroke.
Putnam Tool Grinder.
Screw Machine, 2 in. hole.
Hand Jib Crane, "Cheap."
Allen Port Riveting Mach.

J. J. McCABE,

SUCCESSOR TO E. P. BULLARD'S N. Y. Mach'y Warerooms.

14 Dey St., NEW YORK.

MACHINERY BARGAINS.

10 in. Post Drill.
10 " " Auto. Feed to Table for Butt Drilling.
1, 2 and 3 Spindle Sensitive with and without Power Feed.
2, 3 and 4 Spindle Gang Drills.
20 24, 26, 28, 30 and 44 in. "
30 in. Swing Post Drill.
5 ft. Arm Radial Drill.
12 in. Stroke, 16 in. x 16 in. Crank Planer.
16 in. x 4 ft. Planer.
24 " 4, 5 and 6 ft. Planer.
28 " 5 and 8 " "
30 " 5, 8 and 10 " "
60 " 20 " "
72 " 25 " "
9, 12, 16 24 and 26 in. Stroke Shaper.
10 in. Stroke Slotter.
Hyd. Rivetting Machine.
Crane, Both Al.
Punch and Shear.
Plate Planer.

11 in. x 5 ft. Eng. Lathe.
14 " 6 " " "
15 " 6 and 8 ft. Eng. Lathe.
16 " 5 6, 7 and 10 ft. Eng. "
18 " 6 7 and 8 " " "
20 " 5, 6, 7, 8 and 10 ft. " "
21 " 10 and 13½ ft. " "
24 " 10 " " "
25 " 16 and 24 " " "
26 " 10½ " " "
32 " 16 " " "
35 " 13 " " "
52 " 35 " " "
57 in. Double Head Driving Wheel Lathe.
Bement Car Axle Lathe.
1¼ & 2 in. Bolt Cutter Schenk's.
7 Spd'l Nut Tapper, Dunel.
2 Spd'l Profiler, No. 1 P. & W.
No. 1, 2 and 2½ Screw Machs, P. & W.
No. 1 Lincoln Pattern Miller.
Hand Millers, Screw Slotters, Mill and Cutter Grinders.

Lot of Miscellaneous Machinery, Engines, etc. Send for Latest List.

GEO. PLACE MACHINE CO.,

Offices: 145 BROADWAY and 86 LIBERTY ST.

Warehouse: 511 and 513 WEST 13th STREET,

NEW YORK.

The "Eclipse" Drill, Tool and Graver Sharpener.

The only practical device for the re-sharpening of drills or any other tools requiring a flat surface and fine edge. It can be adjusted to any angle, and by aid of the degree or index marks the drill or tool can be set to the desired angle almost instantly.

Price, Size A $1.75, sent post paid on receipt of price.

EZRA F. BOWMAN & CO.,
22 E. Chestnut St., Lancaster, Pa.

SECOND-HAND MACHINE TOOLS.

ENGINE LATHES.

13 in. x 5 ft. Phenix.
14 " x 6 " Bogart.
15 " x 6 " Blaisdel.
15 " x 8 " Fitchburg.
16 " x 6 " Perkins.
16 " x 7 " Bement.
16 " x 6 " F. E. Reed.
18 " x 6 " New Haven
18 " x 8 " Pease.
18 " x 8 " Blaisdel.
18 " x 10 " "
20 " x 6 " Bullard.
29 " x 12 " Fifield.
30 " x 12 " Blaisdel.
37 " x 14 " Old Style.

PLANERS.

22 in. x 22 in. x 4 ft. L. W. Pond.
24 " x 24 " x 6 " Whitcomb.
24 in. x 24 in. x 10 ft. Pease Planer Co.
28 in. x 28 in. x 7 ft. New Haven.

SHAPERS.

10 in. Juengst Crank.
10 " Wood and Light Traverse Head.
15 in. Juengst Crank.
18 " Putnam Traverse Head.

HAND LATHES.

4 10 in. x 4 ft. Garvin.
1 12 " x 4 ft Garvin.
1 14 " x 4 " Standard.
1 12 " x 5 " Back Geared.
2 20 " x 6 " Back Geared.

MISCELLANEOUS.

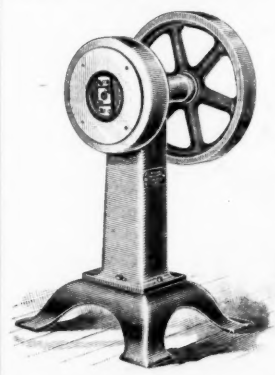
Garvin Profiler, one Spindle, 6 in. Bement Slotter.
42 " Gould & E. Auto. Gear Cutter.
16 in. x 5 ft. Gage Square Arbor Fox Lathes.
5 in. Cutting off Machine.
No. 2 Springfield Tool Grinder.
" 4 " " "
30 in. Squaring Shear.
No. 2 Pratt & Whitney Die Sinker.
No. 3 Garvin Cutter and Tool Grinder.
No. 2 Garvin Cutter and Drill Grinder.
No. 1 Slate Marking Machine.
No. 2 Garvin Automatic Tapper.
Garvin Die Slotter.
Garvin Wire Spring Coiler.

Also, a large number of other machines. Write for complete list and detailed description.

THE GARVIN MACHINE CO.,

LAIGHT & CANAL STS., NEW YORK.
Also 51 North 7th St., Philadelphia, Pa.

COLD SWAGING MACHINE.



The Dayton Swaging Machine is the best for reducing and pointing wire and tubing. If interested address the manufacturers,

EXCELSIOR NEEDLE CO.
Torrington, Conn.

IF YOU HAVE ANY SMALL ARTICLES in Brass or Iron that you want manufactured in quantities, write to The Jones Bros. Electric Co., 28-30-32 West Court St., Cincinnati, O.

SAWS

FOOT OR POWER, FOR METAL OR WOOD. THE BEST. THE FINEST.

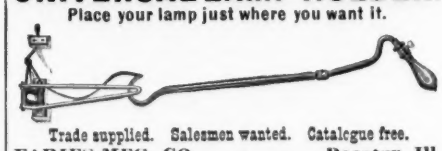
TRUMP BROS. MACHINE CO., Mfrs.,
WILMINGTON, DELAWARE.

For sale by CHAS. CHURCHILL & CO., Ltd., London, England.

IF YOU WANT ANYTHING IN THE LINE OF DROP PRESSES, DROP HAMMERS, STAMPS OR AUTOMATIC DROP LIFTERS.
SEND FOR CATALOGUE TO
Miner & Peck Mfg. Co.
NEW HAVEN, CONN.
LARGEST LINE IN THE MARKET

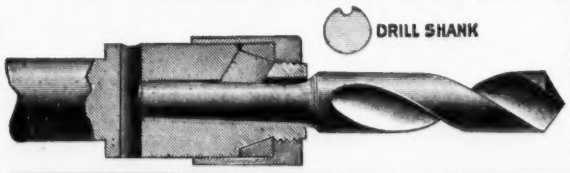
MACHINISTS' SCALES,
PATENT END GRADUATION
We Invite Comparison for Accuracy with all others.
EVERY SCALE GUARANTEED. SEND FOR LIST.
COFFIN & LEIGHTON, SYRACUSE, N. Y.

UNIVERSAL LAMP HOLDER.
Place your lamp just where you want it.



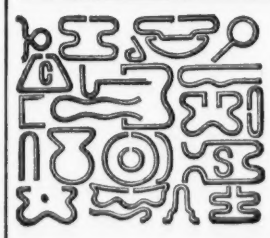
Trade supplied. Salesmen wanted. Catalogue free.
FARIES MFG. CO., - - Decatur, Ill.

The Andrew Patent Drill Chuck.



The original (not copied) device to prevent twisting off Tangs. No extra cost for ANDREW'S reverse incline groove in the shanks. Chucks made direct on new or old spindles. Holds heavy taper-shank tools from dropping out. Best Practical Chuck in the World. Endorsed by all prominent Twist Drill Makers and Mechanical Experts. Send for catalogue.

M. L. ANDREW & CO.,
CINCINNATI, OHIO.



BLAKE & JOHNSON,
WATERBURY, CONN.

Builders of WIRE FORMING MACHINES

With F. B. Manville's Patent Sliding Former,

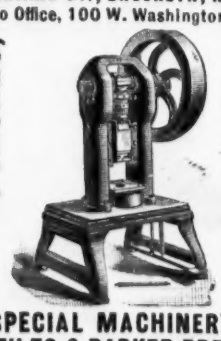
For making articles from the coil, of either round, half-round, flat, or square wire, similar in shape to those shown in the cut herewith. Also similar articles made to order.

Send samples of articles required, and mention quantity wanted, that we may quote prices for either machine or the goods, whichever may be desired.

Bicycle and Labor Saving Machinery a Specialty.

E. W. BLISS CO.

1 ADAMS ST., BROOKLYN, N. Y.
Chicago Office, 100 W. Washington Street.



PRESSES, PUNCHES, SHEARS, DIES, DROP HAMMERS,

SPECIAL MACHINERY.
The STILES & PARKER PRESS CO.

ENGINEERS' MANUAL containing valuable tables, rules, etc., 194 pages, cloth, 50c. 125 page catalogue 10c.
AMERICAN INDUSTRIAL PUB. CO., Bridgeport, Conn.

TOOLS FOR SHEET METAL WORK,

Niagara

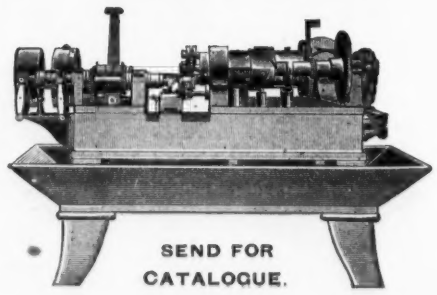
PRESSES, DIES, TINNERS' TOOLS, SHEARS,

NIAGARA STAMPING AND TOOL CO.,
BUFFALO, N. Y.

STEEL BALLS

TRADE MARK — NEW PROCESS STEEL BALLS

For all Anti-Friction Purposes.



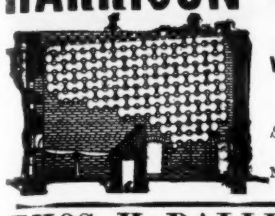
WE ALSO MANUFACTURE

AUTOMATIC SCREW MACHINES
AND
SCREW MACHINE PRODUCT
OF EVERY DESCRIPTION.

Cleveland Machine Screw Co.,
CLEVELAND OHIO.

SEND FOR CATALOGUE.

HARRISON SAFETY BOILER WORKS.

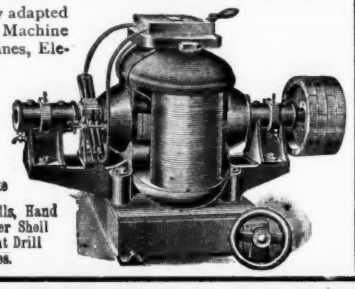


ENGINEERS AND CONTRACTORS FOR
Complete Steam Generating Plants, including
WHARTON-HARRISON SAFETY BOILERS, COCHRANE FEED-WATER HEATERS, HEATERS AND PURIFIERS, SPECIAL HEATERS, COCHRANE SEPARATORS, CAST IRON TANKS, &C.
Specifications and estimates furnished on receipt of details of requirements.
Works and Main Office: GERMANTOWN JUNC., PHILA., PA.
NEW YORK, N. Y.: 616 Havemeyer Building. ATLANTA, GA.: Chas. H. Willcox, DALLAS, TEX.: Hunter & Booso.

THOS. H. DALLETT & CO.,

YORK ST. & SEDGLEY AVE., PHILADELPHIA.
MANUFACTURERS OF
ELECTRIC MOTORS

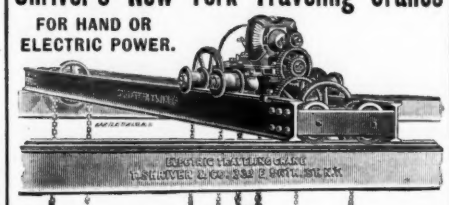
Specially adapted for driving Machine Tools, Cranes, Elevators, Pumps, Presses, and other Machinery.



We also make
Portable Drills, Hand Drills, Boiler Shell Drills, Light Drill Presses.

Shriver's New York Traveling Cranes

FOR HAND OR ELECTRIC POWER.



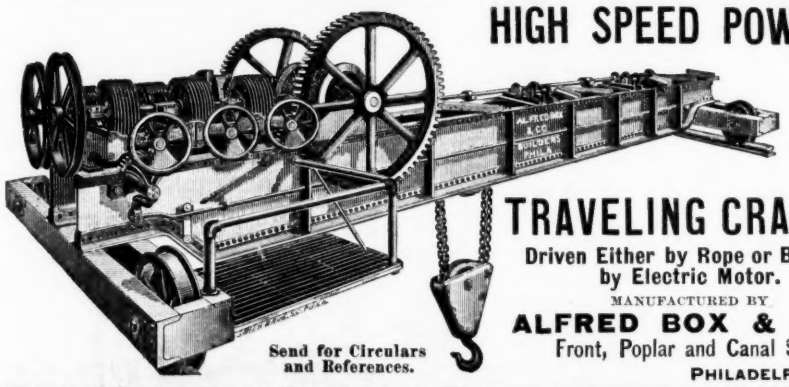
T. Shriver & Co. 333 East 56th St., NEW YORK.
MANUFACTURERS OF
TRAVELING CRANES of 1½, 2, 3, 5 and 10 Tons capacity, to be operated by Hand, or **wholly** or **in part** by Electricity.

EMERY WHEELS

NORTON Emery Wheel Co.
Worcester, Mass.

NEW COMPLETE ILLUSTRATED CATALOGUE FREE.

HIGH SPEED POWER



TRAVELING CRANES

Driven Either by Rope or Belt, or by Electric Motor.
MANUFACTURED BY
ALFRED BOX & CO.,
Front, Poplar and Canal Sts.,
PHILADELPHIA, PA.
Send for Circulars and References.

CRANES, TROLLEYS, PORTABLE HOISTS, OVERHEAD TRACK.
SEND FOR CATALOGUE.

MARIS AND BEEKLEY,

2343 & 2345 Callowhill St., PHILADELPHIA, PA.

A New "SAFETY" Traveling Crane.

Will Hold the Load at any Point.

Latest Improvements.
No Jumping of Chains.
No Jarring of Load. Anti-Friction Bearings.
ADAPTED FOR HEAVY OR LIGHT LOADS
IN
Machine Shops, Foundries, Electric Light and Power Plants.
EDWIN HARRINGTON SON & CO. (INC.),
MACHINE TOOL BUILDERS,
1515 PENNSYLVANIA AVE., PHILA., PA.

"PRACTICAL DRAWING."

By J. G. A. MEYER.

The demand for back numbers of the **American Machinist**, containing this valuable series of articles, has been so great, that, notwithstanding it has compelled us to issue special reprints of several of the articles, our stock is now limited to complete sets, with the exception of two or three issues, and orders can hereafter be filled **by the set only.**

A number of engineering schools are using these articles in lieu of a text book on this important branch of mechanics.

The set of 92 papers will be sent by mail to any address in the U.S., Canada or Mexico for $5.00, postpaid, and to any foreign country for $7.00.

Order now before our stock of papers is exhausted.

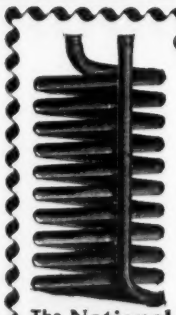
ADDRESS:
American Machinist,
203 BROADWAY,
NEW YORK.

Dixon's Silica Graphite Paint

Will preserve a roof for TEN to FIFTEEN YEARS—perhaps longer, without repainting.
Unequaled for SMOKE STACKS, BOILER FRONTS, Etc.

Send for circulars on Paints and Painting.

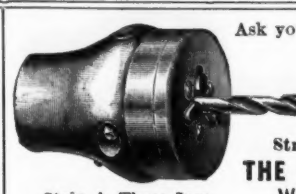
JOS. DIXON CRUCIBLE CO., Jersey City, N. J.



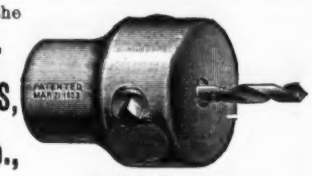
COILS and BENDS of IRON, BRASS, and COPPER PIPE of every description.

The National Pipe Bending Co.
52 River St., New Haven, Conn.

Ask your nearest Dealer, or send to the Manufacturers for



THE LATEST IMPROVED DRILL CHUCKS,



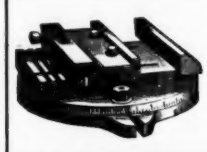
Strong, Accurate, Durable, Cheap.
THE E. HORTON & SON CO.,
Windsor Locks, Conn., U. S. A.
Style A, Three-Jaw. Style B, Two-Jaw.
Or CHAS. CHURCHILL & CO., Ltd., 21 Cross St., Finsbury, London, Eng. **Awards at the World's Fair.**

"CUSHMAN" CHUCKS.

For Lathes, Drills, Chucking and Screw Machines, and for Special work.

SEND FOR CATALOGUE.

THE CUSHMAN CHUCK CO., HARTFORD, CONN.



Jordan Planer Chucks.

For Price and Description, address
C. W. JORDAN
4 Wayne St.,
WORCESTER, MASS.

CHUCKS The "National."

INDEPENDENT, UNIVERSAL, or COMBINATION.
Est'd 1882. Strongest. Easiest to change. Best finish. **Reversible Jaws** (patented) giving 5 changes including every possible position. ILLUSTRATED CATALOGUE sent. Liberal discounts. Prompt shipment. **W. WHITLOCK, 89 Cortlandt St., N. Y.—Works, Hoboken, N. J.**

WE LEAD, OTHERS FOLLOW.

Sweetland Combination Chuck.
Reversible Jaws. Accurate, Standard Independent, Solid Shell, Solid Reversible Jaws, Strong and True.
SEND FOR CATALOGUE.
The HOGGSON & PETTIS MFG. CO., - New Haven, Conn.

THE ONEIDA MFG. CHUCK CO.,

ONEIDA, N.Y., U. S. A.
Manufacturers of **The Monarch Lathe Chuck** and **Little Hercules Drill Chuck.** Write for catalogue direct, or to
Chas. Churchill & Co., Ltd.
21 Cross Street,
Finsbury, London, Eng.

Cranes

CUPOLAS, LADLES, TRUCKS,
Whiting Foundry Equipment Co.,
225 DEARBORN ST., CHICAGO | HARVEY, ILL.
NEW YORK OFFICE, 182 FRONT ST.

NO MACHINIST

will do without it, if he ever saw or used one of the
"COLUMBIA" CALIPERS.
WHY NOT GET ONE YOURSELF?
For Catalogue and Prices address,
E. C. SMITH, Columbia, Pa.

BOSTON GEAR WORKS

35 Hartford St., Boston, Mass.

Book on Gears, 170 Illustrations, $1.00. Job Gear Cutting of all kinds, Spur, Bevel, Spiral, Ratchet, Worm, Rack, Elliptic, Index Plates, Noiseless, Fiberoid Gears, etc. Very small or large. Send for 1894 Catalogue. 1100 sizes of Gears.

SOFT CASTINGS,

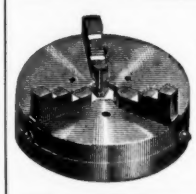
Made from best grades of Pig Iron for Light Machinery, Electric Work, etc.
THE BURR & HOUSTON CO.,
33 TO 39 FRANKLIN ST., BROOKLYN, N. Y.

CASTINGS

For Machinery of any size, from patterns or drawings. Quality and finish unsurpassed. Prices way down.
L. E. HOYT & CO.,
WALTON, DEL. CO., N. Y.
New York Agent, CLEVELAND FOOTE, 47 Broadway.

PEQUOT DRILL CHUCK.

A new Drill Chuck having a more powerful grip than any chuck ever offered. This seems a broad claim, but we prove it to mechanics who will examine. Ask at your dealers or write us for particulars.
THE D. E. WHITON MACHINE CO.,
5 Oak Street, New London, Conn, U. S. A.,
OR, SELIC, SONNENTHAL & CO.,
85 Queen Victoria St., London, E. C., England.



SKINNER CHUCKS.

Independent and Universal Chucks, Combination Lathe Chucks with patent reversible jaws, Drill Chucks, Planer Chucks and Face Plate Jaws.
SKINNER CHUCK CO.,
New Britain, - - Conn.
SEND FOR CATALOGUE.

Write **The Pratt Chuck Co.**, Clayville, N. Y., U. S. A., for free illustrated catalogue of

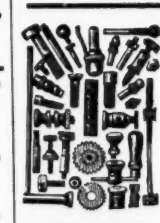
POSITIVE DRIVING DRILL CHUCKS.

Will drive either straight or Taper Shank Drills, Reamers, Rose Bits, etc., of any size, without a possibility of their slipping.

FOREIGN AGENCIES:
Ph. Roux et Cie., 54 Boulevard du Temple, Paris, France; E. Sonnenthal, Jr., Neue Promenade No. 5, Berlin, Germany; Selig, Sonnenthal & Co., 85 Queen Victoria St., London, E. C., England.

Almond Drill Chuck.

Sold at all Machinists' Supply Stores.
T. R. ALMOND,
83 & 85 Washington St.,
BROOKLYN, N. Y.



Special Screws and Studs in Brass or Steel.

Gear Cutting, Sheet Metal Stamping, Automatic Machinery built to order. Send sample or drawing for estimate.
SITTMANN & PITT,
353 ADAMS ST., BROOKLYN, N. Y.

Why not buy a good MICROMETER DEPTH GAUGE?

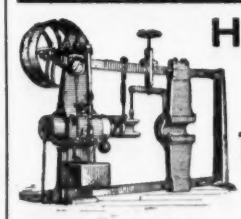
By buying one in combination with our Inside Micrometer Caliper you get the depth gauge for only 75 cents or the whole tool for $2.50. It will pay you to write for circular.
J. T. SLOCOMB & CO., Providence, R. I.

EVERY MACHINIST SHOULD HAVE A COPY OF

OUR CATALOGUE.

It is a 704 page cloth bound book. A copy will be sent, express paid, to any one sending $1.00, and the money paid for book will be refunded with first order amounting to $10.00 or over.

MONTGOMERY & CO.,
105 FULTON STREET,
NEW YORK CITY.



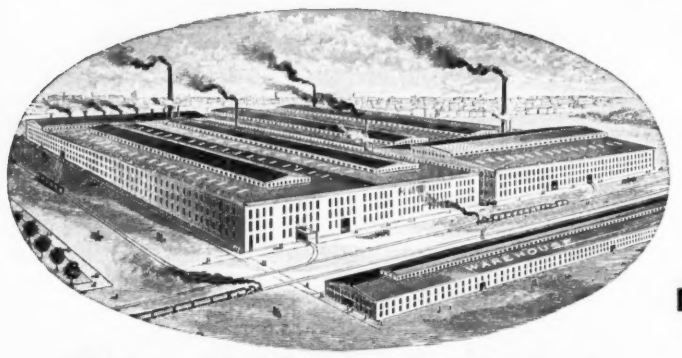
Hydraulic Wheel Press.

HYDRAULIC MACHINERY.

PRESSES, PUMPS, PUNCHES, JACKS,
VALVES, FITTINGS, PACKINGS, ACCUMULATORS.
SEND FOR CATALOGUE D.
THE W. & S. HYDRAULIC MACHINERY WORKS,
WATSON & STILLMAN, Proprietors.
204, 206, 208 and 210 East 43d Street,
NEW YORK.

Vertical Check Valve.

THE LODGE & DAVIS MACHINE TOOL CO.,



Works, Cincinnati, O., U. S. A.

DESIGNERS AND BUILDERS OF

MACHINE SHOP EQUIPMENTS,

including Standard Engine Lathes, Planers, Shapers, Radial and Upright Drills, Milling Machines, Screw Machines, Bolt Cutters, etc.

BRANCH HOUSES:

NEW YORK, 110 LIBERTY ST.
CHICAGO, 68-70 S. CANAL ST.
PHILADELPHIA, 19 N. SEVENTH ST.
BOSTON, 23-25 PURCHASE ST.
ST. LOUIS, 823 N. SECOND ST.
PITTSBURGH. WATER AND MARKET STS.

Lathes

OUR PAT. RADIAL DRILLS ARE BEST.

Good tools produce good work, we use only the finest machinery and employ the most skilled Mechanics, hence, are in position to offer the best Mechanisms to be obtained at a moderate price.

ENGINE LATHES.

22" and 24" furnished in lengths of 8, 10, 12, 14, and 16 feet Bed.

With all modern Improvements.

Address,
Dietz, Schumacher & Co.,
Cincinnati, O., U. S. A.

DROP FORGINGS

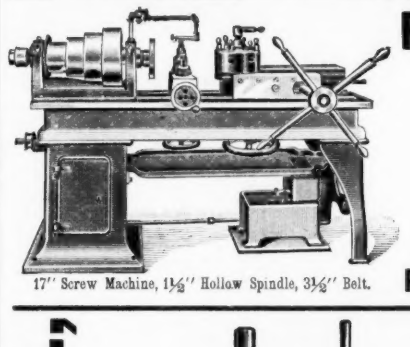
WYMAN AND GORDON
WORCESTER, MASS.

ENGINE-LATHE IMPROVEMENTS.

Independent of Increased Diameters of Cones and Bearings.

DIAMETERS AND LENGTHS may be made without the use of rules or calipers
DIAMETERS REPEATED ABSOLUTELY either in turning or chasing, also without calipers.
WITHDRAWING THE TOOL reverses the carriage when screw-cutting.
CHANGE GEARS are all steel and mounted on one shaft.
CUTS THE ENTIRE INDEX of screws without removing a single gear and cuts spirals a duplicate of screw-cutting index.
MOST SUBSTANTIAL in design. Price, just where you can afford it.
GUARANTEED equal to any tool made, in accuracy, solidity and workmanship.
SIZES, 18", 22", 26' and 30" for quick delivery.
Write for "25 Points of Excellence," important as above.

THE LODGE & SHIPLEY M. T. CO., CINCINNATI, O., U. S. A.



17" Screw Machine, 1½" Hollow Spindle, 3½" Belt.

FLATHER & COMPANY,

NASHUA, N. H., U. S. A.

LATHES,

SCREW MACHINES,

PLANERS AND SHAPERS.

STUART'S PATENT COMPRESSION WEDGE COUPLING.

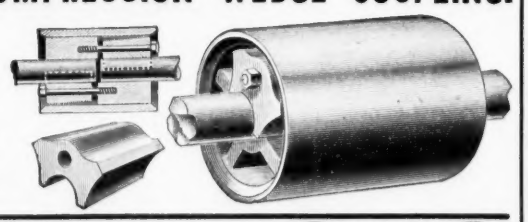
NO KEYS. KEY SEATING. SLIPPING.

CHEAPEST in MARKET, also the SIMPLEST and BEST.

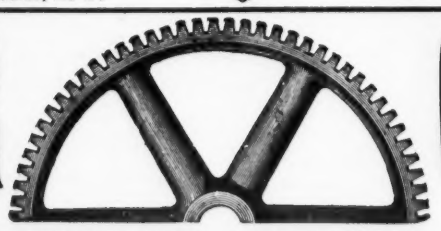
SENT ON TRIAL.

Can be attached or removed in a few seconds without injury to shaft or coupling. Send for discount and illustrated Price List of 40 sizes.

R. J. STUART'S FOUNDRY AND MACHINE WORKS,
NEW HAMBURGH, N. Y.

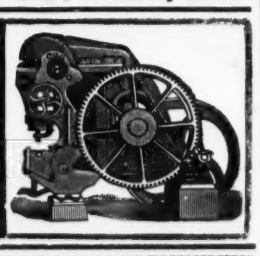


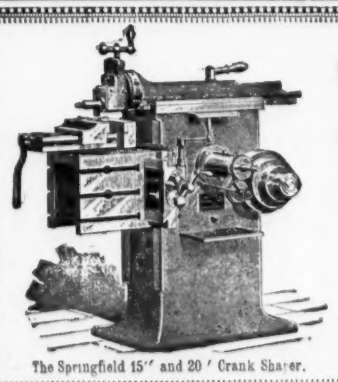
GEARS CUTTING



LELAND, FAULCONER & NORTON CO. Detroit, Mich.

PUNCHING AND SHEARING MACHINERY
AND BOILER MAKERS ROLLS.
NEW DOTY MANUFACTURING CO.
JANESVILLE WISCONSIN.





The Springfield 15" and 20' Crank Shaper.

600 IN USE!
Second Largest Builders in the U. S. of

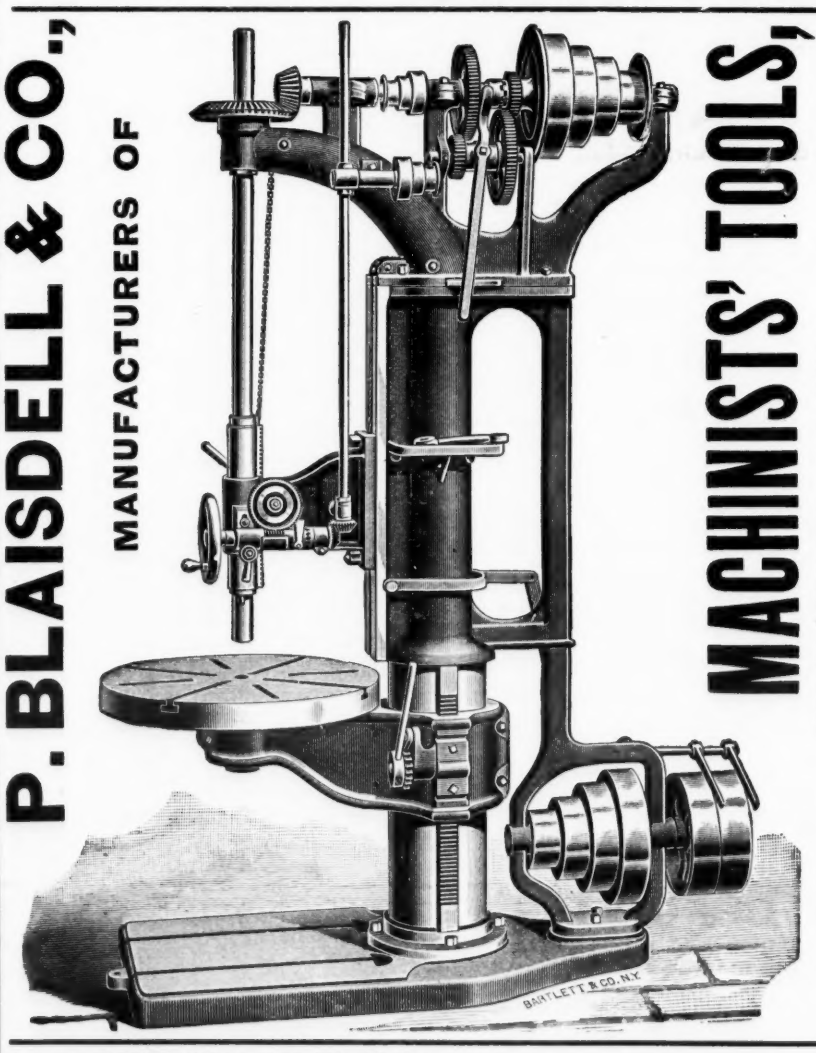
15" and 20" Crank Shapers

Stroke adjustable while running.
Stroke always positive. The vise is swiveled, and centres furnished.
Improved Box table, and removable.
Heavily Geared.—**Strong, Heavy and Rapid.** Write us.

THE SPRINGFIELD MACHINE TOOL CO.,
SPRINGFIELD, OHIO.

P. BLAISDELL & CO.,

MANUFACTURERS OF



MACHINISTS' TOOLS,

WORCESTER, MASS.

SEND FOR CATALOGUE. MENTION THIS PAPER.

LANDIS BROS., WAYNESBORO, PA.,

MANUFACTURERS OF

Universal and Plain Grinding Machines.

Any speed between maximum and minimum of work and traverse of wheel acquired in an instant. Provided for free use of water in all grinding operations. For convenience unequalled. Fully guaranteed.

SEND FOR CATALOGUE.

England: Chas. Churchill & Co., 21 Cross St., Finsbury, London, E. C.

France and Belgium: Ad'Janssens, 16 Place de la Republique, Paris.

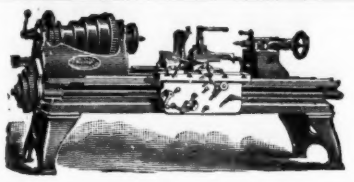
No. 3 UNIVERSAL GRINDER.

MORSE TWIST DRILL AND MACHINE COMPANY,

Manufacturers of Morse Patent Straight-Lip Increase Twist Drills. New Bedford, MASS.

Solid and Shell Reamers, Beach's Patent Self-Centering Chuck, Bit Stock Drills.
DRILL GRINDING MACHINES, MILLING CUTTERS AND SPECIAL TOOLS TO ORDER.

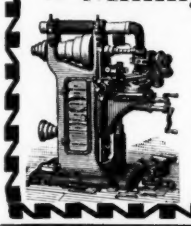
F. E. REED CO.,
Worcester, Mass.,
MANUFACTURE
ENGINE LATHES
HAND LATHES, FOOT LATHES AND MILLING MACHINES.
Manning, Maxwell & Moore,
Selling Agents, 111 Liberty St., New York.
60 South Canal St., Chicago.



NEW HAVEN MANFG. CO.
NEW HAVEN, CONN.
IRON-WORKING MACHINERY,
Planers, Shapers, Drills, Slotters, Etc.

W. C. YOUNG MFG. CO., WORCESTER, MASS.
Foot Lathes, Engine Lathes,
SHEARS AND PUNCHES.

A Milling Machine or . . . .
a Cutter and Tool Grinder.



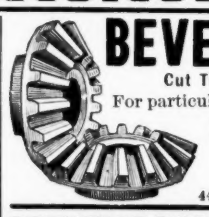
If you need either, and where is the shop that doesn't? write
The Cincinnati Milling Machine Co.,
Cincinnati, Ohio.

ENGINE LATHES. . . . .
HAND LATHES. . . . . .

Draper Machine Tool Co.
Successor to LATHE & MORSE TOOL CO.
WORCESTER, MASS., U. S. A.

. . . . PLANERS.
. . . . CRANK PLANERS.

OUR NEW CUTTING-OFF MACHINES.
TOOL BLOCKS
ARE GREAT!
HAVE YOU
SEEN THEM?
HURLBUT ROGERS MACH. CO., 80 SUDBURY, MASS.



BEVEL GEARS,
Cut Theoretically Correct.
For particulars and estimates apply to
HUGO BILGRAM,
MACHINIST,
Successor to
BREHMER BROS.,
440 N. 12th St., Philadelphia, Pa.

PRENTICE BROS., Worcester, Mass.

Standard Tool Room Lathe.
Double Back Geared Head.
11 to 21-inch swing.

Makers of Vertical Drill Presses, 12 to 50-inch swing, Radial Drills, Gang Drills, Boiler Makers' Drills, Radial Drilling and Countersinking Machines, for ship plate and bridge work, Special Drilling Machinery
Engine Lathes from 11 to 21-inch swing, any length of bed, with single or double back-geared heads and any style of rest, with or without taper attachment. SEND FOR CATALOGUE.
FOREIGN AGENTS:
CHAS. CHURCHILL & CO., L'td, London, Eng.
SCHUCHARDT & SCHUTTE, 59-61 Spandauerstrasse, Berlin, Germany.
ADPHE JANSSENS, 16 Place de la Republique, Paris, France.

OUR FULL LINE.

Upright
Radial
Universal Radial
Boiler Makers
Multiple
} DRILLS.
Boring and Turning Mills.
Combination Drilling.
Boring and Turning Machines.

BICKFORD DRILL AND TOOL CO.,
3 Pike Street, Cincinnati, Ohio.

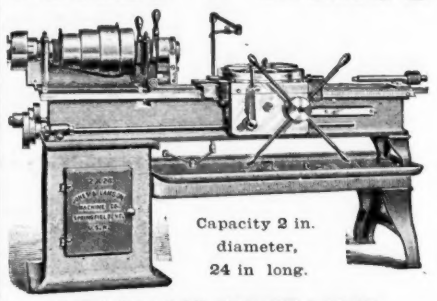
D. SAUNDERS' SONS,

21 ATHERTON ST., Yonkers, N. Y.
MANUFACTURERS OF
Steam & Gas Fitters' Hard Tools.
Pipe Cutting, THREADING, AND Tapping Machines.

SEND FOR CIRCULAR.

THE PATENT WHEEL PIPE CUTTER shown in the cut combines simplicity with strength and lightness. Easily adapted to various sizes of pipe. Rolling instead of sliding motion. No loose parts to become detached and mislaid. All wearing surfaces are of tool steel hardened. Less friction of parts than any other pipe cutter made.

JONES & LAMSON MACHINE CO.,
SPRINGFIELD, VERMONT.

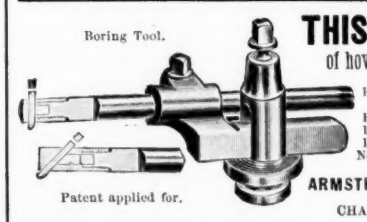


Capacity 2 in. diameter, 24 in. long.

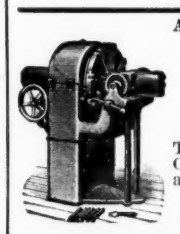
Sole builders of the Flat Turret Lathe, also builders of other Turret Machinery. Publishers of "Rapid Lathe Work," by new method (Hartness System). Send for catalogue.

2 BY 24 FLAT TURRET LATHE.

THIS WILL GIVE YOU AN IDEA
of how these tools gain in favor after being once tried.



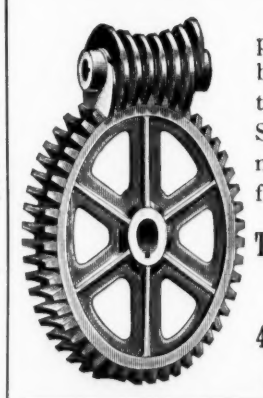
PROVIDENCE, R. I.
From BUILDERS IRON FOUNDRY.
Aug. 15th, 1892. Please send us 1 No. 5 Tool Holder. July 12th, 1893. Send us at once 12 No. 1, 12 No. 2 and 12 No. 3 Tool Holders. Aug. 21st, 1893. Ship us via Express at once, 6 No. 5 and 6 No. 6 Tool Holders.
For circulars, prices, etc., send to
ARMSTRONG BROS. TOOL CO., 76 Edgewood Ave., Chicago,
Or to your nearest first-class dealer.
CHAS. CHURCHILL & CO., Ltd., London, Eng., Agents.



ARMSTRONG'S
Pipe Threading and Cutting-Off Machines.
Both Hand and Power.
Sizes 1 to 6 inches.
Water, Gas and Steam Fitters' Tools, Hinged Pipe Vises, Pipe Cutters, Stocks and Dies universally acknowledged to be THE BEST.
Send for Catalogue.
ARMSTRONG MFG. CO.,
Bridgeport, Conn.

NEW BENCH DRILL.
Flat Belt, Rack and Pinion Feed.
(Write for Circular.)
D'AMOUR & LITTLEDALE, 204 E. 43d St., New York.

Albro Worm and Worm Gear

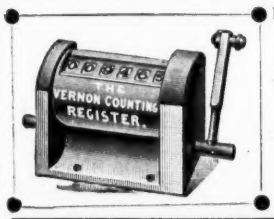


Consumes less power and gives better results than any other System. Information cheerfully furnished.
The Albro-Clem Elevator Co.,
411 & 413 Cherry St.,
Philadelphia, Pa.

SEND FOR CATALOGUE.
WORCESTER MACHINE SCREW CO.

Manufacturers of Set, Cap & Machine Screws, Studs, etc.

THE VERNON
Revolution Counters, Car Fare Registers, &c.



Positive Motion.
Steel Gearing.
Brass Wheels.
Absolutely Accurate.
S. M. BALZER,
Manufacturer of Counting and Measuring Machines.
129 Worth Street
NEW YORK.

MECHANICS

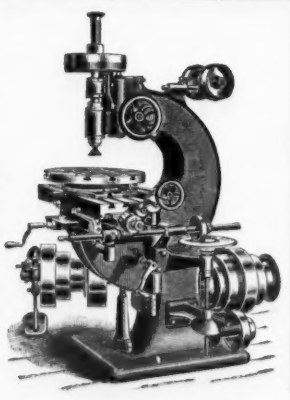
DIPLOMAS AWARDED. Courses in other trades, all including thorough instruction in Mathematics and Physics. Send for FREE circular, stating subject you wish to study to
THE
Correspondence School of Mechanics
SCRANTON, PA.

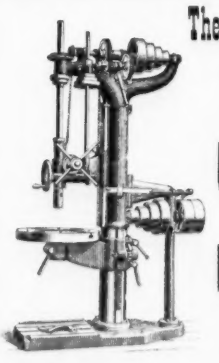
W. D. FORBES & CO.,
ENGINEERS,
1300 HUDSON STREET, HOBOKEN, N. J.

BINDING POSTS, CONTACT BUTTONS AND ALL ELECTRICAL MACHINE WORK.
(TWO BLOCKS FROM 14TH ST. FERRY.)

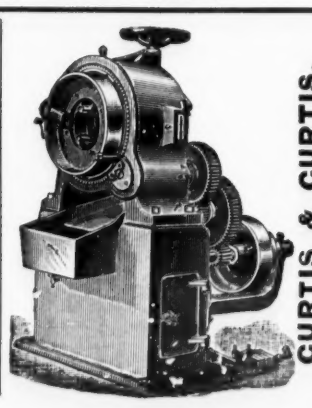
FINE MACHINE WORK,
LIGHT FORGING,
DRAUGHTING AND DESIGNING.

THE BECKER MILLER No. 4
MANUFACTURED BY
JOHN BECKER MANUFACTURING CO.,
FITCHBURG, MASS.





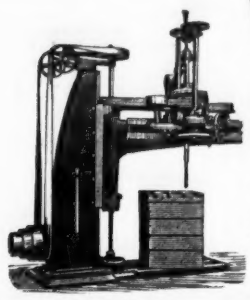
The Aurora Tool Works,
AURORA, IND.
BUILDERS OF
UPRIGHT AND RADIAL DRILLS.



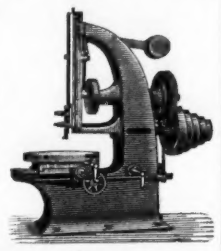
CURTIS & CURTIS,
66 CARDEN ST., BRIDGEPORT, CONN.
Pipe Cutting and Threading Machinery,
FOR HAND OR POWER,
RATCHET DRILLS, RATCHET DIE STOCKS AND MALLEABLE IRON PIPE VISES.

BARNES'
New Friction Disk Drill
FOR LIGHT WORK.

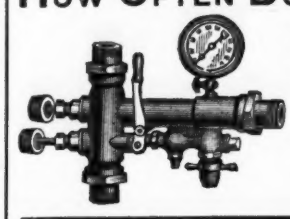
Has these Great Advantages: The speed can be instantly changed from 0 to 1600 without stopping or shifting belts. Power applied can be graduated to drive with equal safety the smallest or largest drills within its range—a wonderful economy in time and great saving in drill breakage. Send for catalogue.
W. F. & JNO. BARNES CO.,
1995 RUBY ST., ROCKFORD, ILL.
ENGLISH AGENTS,
CHAS. CHURCHILL & CO., Ltd.
21 CROSS ST., FINSBURY,
LONDON, E. C., ENGLAND.



WM. SELLERS & CO., Incorporated,
PHILADELPHIA, PA.
MANUFACTURERS OF
MACHINE TOOLS,
TRAVELING CRANES AND SWING CRANES,
Operated by Electricity, Shafts or Independent Engines.
Turn Tables, Testing Machines, Shafting, Pulleys, Hangers, Couplings, Etc.
INJECTORS FOR ALL CLASSES OF BOILERS.



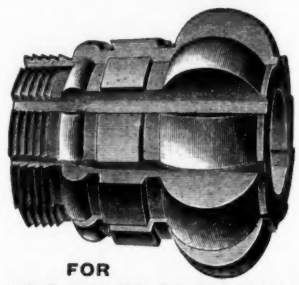
How Often Do You Wash Out Your Boilers,
and how do you do it? Did you ever apply the water test to them? Are you acquainted with the
RUE BOILER WASHER AND TESTER?
If not, send for Catalogue which will not only give you full particulars, but contains other information useful to every mechanic, engineer or boiler owner.
Rue M'f'g Co., 118 N. 9th St., Philadelphia, Pa.



The LONG & ALLSTATTER CO.
HAMILTON, OHIO.
DOUBLE, SINGLE, HORIZONTAL, TWIN, MULTIPLE AND AUTOMATIC SPACING.

SPLICE BAR PUNCH.
BELT, STEAM AND ELECTRICALLY DRIVEN
POWER PUNCHES AND SHEARS.

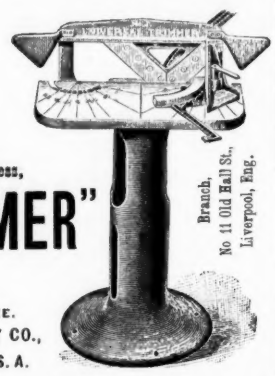
FORMED MILLING CUTTERS.



FOR
MILLING PARTS OF MACHINERY.
These Cutters are made in a great variety of outlines, and can be sharpened by grinding without changing their form. They are economical in producing duplicate and interchangeable parts. Exact duplicate cutters can be made at any time. This is of great importance when accuracy in duplication of machine parts is required.
Catalogue of Milling Cutters and Fine Mechanical Tools free.
L. S. STARRETT, Box 14 Athol, Mass., U. S. A.

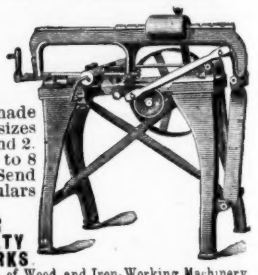
AUTO MATIC
PENBERTHY
INJECTOR
PENBERTHY INJECTOR CO. M'F'R'S, DETROIT, MICH.

Cable Address,
"TRIMMER"
CATALOGUE FREE.
AMERICAN MACH'Y CO.,
DETROIT, MICH., U. S. A.



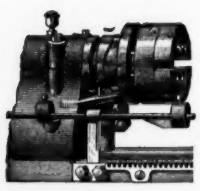
Branch,
No 11 Old Hall St.,
Liverpool, Eng.

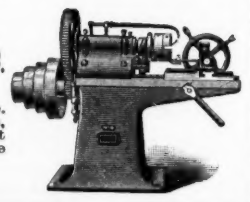
Stover Power Hack Saw and Friction Drills.



Saws made in two sizes Nos. 1 and 2. Cut 4½ to 8 inches. Send for circulars to
STOVER NOVELTY WORKS
Mfgrs. of Wood and Iron-Working Machinery.
Special Machinery to order
23 River St., FREEPORT, ILL., U. S. A.
C. W. BURTON, London, Eng.

DETRICK & HARVEY MACHINE CO.,
BALTIMORE, MD.
MANUFACTURERS OF THE
ADAMS
Automatic Bolt-Threading and Nut-Tapping Machine.
Made in all Sizes to Cut from 1-4" to 6".
The simplest and most durable machine in existence. The threading head is made entirely of steel. No links, levers, springs, caps, cases, blocks or die rings in or about the head. Separate Heads and Dies Furnished. Write for descriptive circular and price list.
Manufacturers of The Open Side Iron Planer.





BACK VOLUMES OF THE AMERICAN MACHINIST
For any of the fourteen years, 1880 to 1893, inclusive, may still be obtained, but must be ordered soon, as our stock is nearly exhausted. Price, unbound, $3.00 per volume postpaid. Bound in cloth, $4.00 per volume (purchaser paying freight or express charges). No separate back numbers prior to 1893 are now carried in stock. Only complete volumes furnished prior to 1893.
AMERICAN MACHINIST, 203 Broadway, New York.

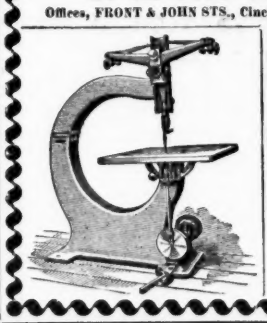
CATCH ON NOW.
You'll never get another chance.
To any one sending us TEN CENTS (stamps or silver), previous to October 1st, we will mail one of our best two inch STEEL RULES with ends HARDENED, Only one rule to the same address.
STANDARD TOOL CO.,
ATHOL, MASS., U. S. A.
MANUFACTURERS OF
MECHANICS FINE TOOLS.

CHAS. A. STRELINGER & CO.,
Tools, Supplies and Machinery
DETROIT, MICH.

THE PERKINS DRAW STROKE TRIMMER,

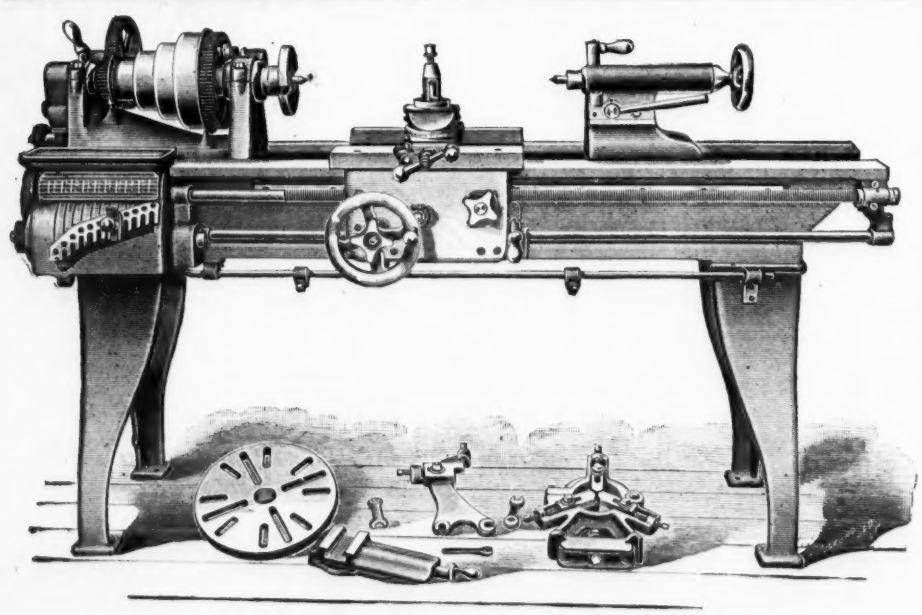
An Indispensable Tool for all Bench Wood workers. Latest and Best Design. Infringers Prosecuted. Trial, not orders, solicited.
PERKINS & CO., Grand Rapids, Mich.
STOCKS, NEAVE & CO., Manchester, England.

J. A. FAY & CO.,
Offices, FRONT & JOHN STS., Cincinnati, O., U. S. A.



MAKERS OF
Wood-working Machinery
FOR ANY PURPOSE.
"Grand Prix" Paris.
Highest Awards Chicago.
PRINTED MATTER ON APPLICATION.

ROBERT POOLE & SON CO.
ENGINEERS & MACHINISTS.
TRANSMISSION MACHINERY
MACHINE MOULDED GEARING
SPECIAL FACILITIES FOR THE
HEAVIEST CLASS OF WORK
BALTIMORE, MD.



14 in. x 6 ft. Hendey-Norton Lathe with Improved Automatic Stop.

EUROPEAN AGENTS:
SCHUCHARDT & SCHUTTE, 59 Spandauerstrasse, Berlin.
CHAS. CHURCHILL & CO., L'd 21 Cross Street, Finsbury, London.
EUGEN SOLLER, Basel, Switzerland.

THIS Lathe COMBINES the LATEST and BEST Improvements. Automatic Stop. It is Simple, Durable, Indispensable. It will AUTOMATICALLY STOP the Carriage in EITHER direction. It is equally efficient whether FEEDING or THREAD-CUTTING. Running up to a shoulder, boring to BOTTOM of holes, or INTERNAL THREAD-CUTTING. No danger of spoiling either tool or work. It is a safeguard against accidents, in either direction.

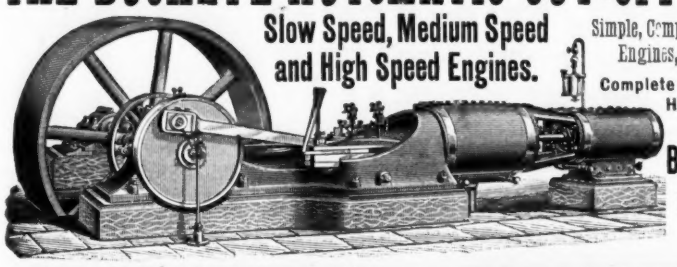
Feeds—It has all feeds in daily use with simple movement of lever.

Threads—It has all threads in daily use with simple movement of lever.

Carriage—The Carriage reverses in Apron. No slamming of Countershaft. There is no Comparison between this Lathe and the old style or common lathe. Quick work, rapid changes, satisfactory results. Buy the best. Send for Circular.

THE HENDEY MACHINE CO.,
TORRINGTON, CONN.

THE BUCKEYE AUTOMATIC CUT-OFF ENGINES,



Slow Speed, Medium Speed and High Speed Engines.

Simple, Compound, and Triple Expansion Engines, High Pressure Boilers.

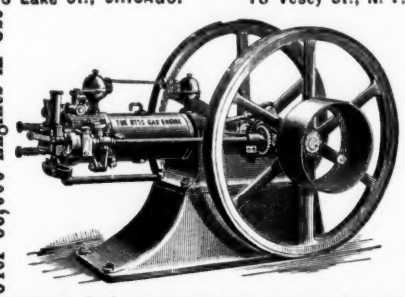
Complete Steam Power Plants of Highest Attainable Efficiency. Address

Buckeye Engine Co.
No. 26 Franklin Ave.,
SALEM, O.

"OTTO" GAS ENGINE WORKS.

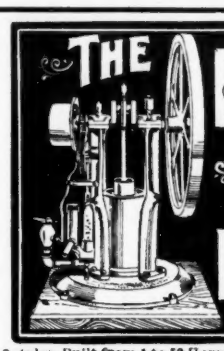
SCHLEICHER, SCHUMM & CO.,
33d and Walnut Sts., PHILADELPHIA.
Branch Office, 245 Lake St., CHICAGO.
New York Agency, 18 Vesey St., N. Y.

Over 35,000 Engines in Use



Guaranteed to consume 25 to 75 per cent. less Gas than any other Gas Engine doing the same work.

THE BACKUS GAS ENGINE



2 styles, Built from 1 to 50 Horse Power. Send for Circular.
BACKUS WATER MOTOR CO., Newark, N.J.
Also Mfrs. VENTILATING FANS.

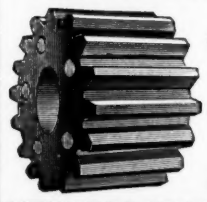
THE PERFECT DRAWING TABLE

With Adjustable Parallel Ruler, More Reliable Than The Old T-Square.

30x42 $30. 36x48 $35. 36x60 $40.

Henry J. Hughes,
360 45TH STREET,
BROOKLYN, N. Y.

STRANGE, BUT TRUE!!
THE NEW PROCESS RAW HIDE GEARS
ASTONISH THE
MACHINERY WORLD.



They **Outwear any Metal.**

They require **No Lubricant.**

They are **Noiseless and Clean.**

NEW PROCESS RAW HIDE CO.,
PATENTEES AND SOLE MANUFACTURERS,
SYRACUSE, N. Y., U. S. A.

MACHINERY
For Reducing and Pointing Wire.
ESPECIALLY ADAPTED TO POINTING WIRE RODS AND WIRE FOR DRAWING.
For Machines or Information address the Manufacturer,
S. W. GOODYEAR, Waterbury, Conn.

ADJUSTABLE HOLDERS FOR INCANDESCENT LAMPS.

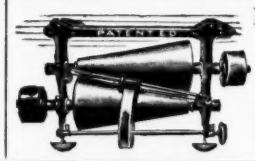
O. C. WHITE CO. WORCESTER, MASS.
SEND FOR CIRCULARS.

Engineering Courses for Special Students.

The Bromfield-Pearson Technical School, of Tufts College, offers exceptional opportunities to students who wish to pursue a two years course in Engineering or who may desire to fit for the Engineering Courses of the college in one year. For information apply to

GARDNER C. ANTHONY, Dean,
Tufts College, Mass.

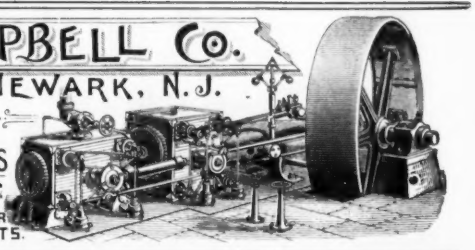
EVANS FRICTION CONE CO.



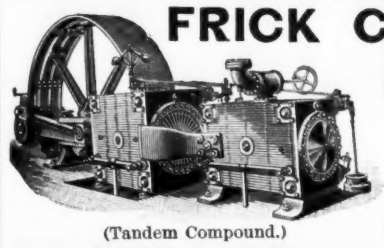
HANGING AND STANDING
CONES,
MADE IN ALL SIZES.
Thousands in use transmitting from 1 to 50 H. P. For information address,
No. 85 WATER STREET,
BOSTON, MASS.

THE WATTS, CAMPBELL CO.

MANUFACTURERS OF IMPROVED CORLISS STEAM ENGINES IN FULL VARIETY.
CONTRACTS TAKEN FOR COMPLETE POWER PLANTS.
NEWARK, N. J.



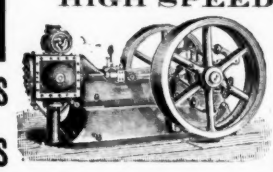
FRICK COMPANY, WAYNESBORO, PA.



(Tandem Compound.)

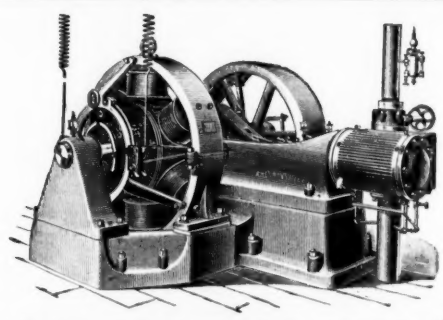
ECLIPSE CORLISS ENGINES,
40 TO 2,000 H. P., ALL STYLES.
Send for Illustrated Catalogue.
ALSO BUILDERS OF
Electric High Speed Engines and Ice-Making and Refrigerating Machinery.

WESTON AUTOMATIC HIGH SPEED ENGINES



HIGH PRESSURE BOILERS AND COMPLETE POWER PLANTS

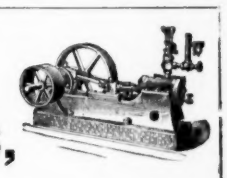
WESTON ENGINE CO.,
PAINTED POST, N. Y.
REPRESENTATIVES.
Julian Scholl & Co., 126 Liberty St., N. Y. City.
Scranton Supply & Machinery Co., Scranton, Pa.
Hoffman-Russell Co., 82 Lake St., Chicago, Ill.
H. M. Seiple & Co., 3d & Arch Sts., Phila, Pa.



AMES IRON WORKS, OSWEGO, N.Y.

38 Cortlandt Street, New York City.
18 South Canal Street, Chicago, Ill.
50 Oliver Street, Boston, Mass.
518 Arch Street Philadelphia, Pa.

ORR & SEMBOWER,
(INCORPORATED.)
VERTICAL, HORIZONTAL, MARINE
— AND —
HOISTING ENGINES,



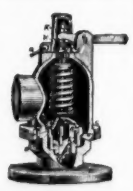
VERTICAL AND HORIZONTAL BOILERS.
WRITE FOR CATALOGUE AND PRICES.
116 Liberty St., NEW YORK. Factory at READING, PA. 42 S. Clinton St., CHICAGO.

THE LANE & BODLEY CO.

CINCINNATI, OHIO.
SHAFTING, HANGERS, PULLEYS.
(Turned) (Strong, self-oiling) (Good proportions)
SPECIAL STANDS FOR HEAVY SHAFTING.
CORLISS ENGINES,
Belt Elevators, Saw Mills, Etc.
COMPLETE POWER EQUIPMENT.

LONERGAN'S SPECIALTIES

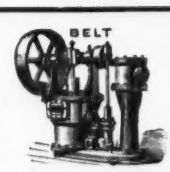
Oil Cups for all Purposes. Sight Feed Lubricators, Pop Safety Valves, Check Valves, Water Relief Valves, etc. "Clipper" Injectors, and other Steam Appliances.



J. E. LONERGAN & CO., 211 Race St., Phila., Pa.
CATALOGUE FREE ON APPLICATION.

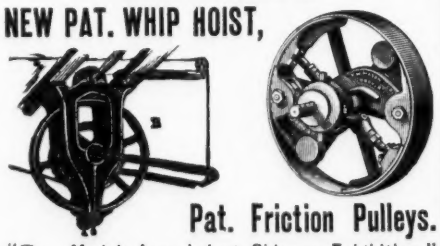
CONOVER'S HANDSOME CATALOGUE ON CONDENSERS

IN STOCK



THE CONOVER MFG. CO. 39 CORTLANDT ST. N.Y.

VOLNEY W. MASON & CO.,
MANUFACTURERS OF
NEW PAT. WHIP HOIST,



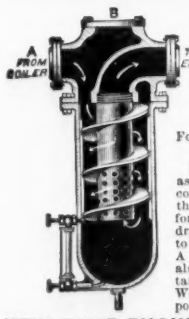
Pat. Friction Pulleys.
"Two Medals Awarded at Chicago Exhibition."
PROVIDENCE, R. I., U. S. A.

SENSITIVE DRILLS.
COPYRIGHTED TRADE-MARK.
Do you know
that we make
the largest,
the best,
line of Hand, Foot, and Automatic
Feed Drills for ½-inch holes and less.
Endless belts.
Short belts discarded.
Patented Improvements.
No belt tension on spindles.
1, 2, 3, 4, or more spindles.
Investigate. Read up.
84-page Catalogue free.
DWIGHT SLATE MACHINE CO.,
HARTFORD, CONN.

STEEL CASTINGS

FROM 1 TO 40,000 POUNDS WEIGHT.
Of Open Hearth, Chester or Bessemer Steel.
True to Pattern. Sound. Solid.
GEARING OF ALL KINDS, CRANK SHAFTS, KNUCKLES FOR CAR COUPLERS.
Cross-Heads, Rockers, Piston-Heads, etc., for Locomotives. Steel Castings of Every Description.
CHESTER STEEL CASTINGS CO.,
Works, Chester, Pa. Office, 407 Library St., Philadelphia, Pa.

DRY STEAM.



Simpson's Centrifugal Steam Separator.

For Supplying Clean and Dry Steam to Engines, Dry Houses, etc.

Place Separator as close to engine as possible, the steam taking a spiral course between the threads causes the water to be thrown by centrifugal force against the outer walls, while the dry steam goes through the small holes to center of pipe. Steam can enter at A or B, as convenience may require; also used in conveying steam long distances, for Steam Hammers, Dry Houses, Water Gas Generators, and for all purposes where Dry Steam is necessary.

KEYSTONE ENGINE & MACHINE WORKS.
Fifth and Buttonwood Streets, Philadelphia.

MOFFET PORTABLE DRILL.

UNSURPASSED AS A **REAMER.**

Will work in any position.

Weighs 42 lbs. and drills from ⅜ to 2 inches diameter.

Runs with Steam —OR— Compressed Air.

Send for Circular.

Manufactured by
J. G. TIMOLAT,
89 & 91 S. Fifth Ave.,
NEW YORK.

A. & F. BROWN,
ENGINEERS, FOUNDERS & MACHINISTS.

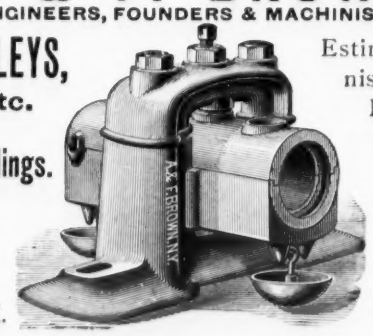
SHAFTING, PULLEYS, HANGERS, Etc.

Friction Clutch Couplings.

STEAM SIRENS, [WHISTLES].

Send for Catalogue.

17 Dey St., New York.



Estimates and Plans furnished for transmitting Power by

HORIZONTAL AND VERTICAL SHAFTING.

Also for Erecting same.

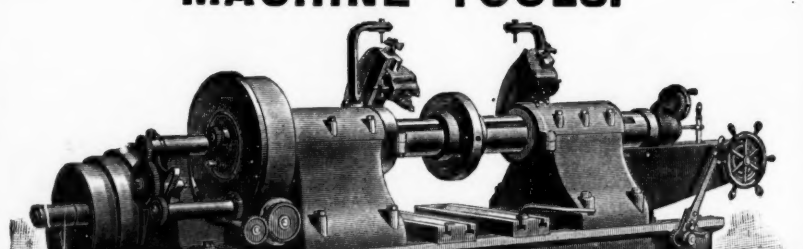
TO OUR PATRONS.

August, 20th.

At the close of our Annual Vacation, work will be resumed, as usual, in all departments of our establishment.

BROWN & SHARPE MFG. CO.,
DARLING, BROWN & SHARPE.
PROVIDENCE, R. I.

MACHINE TOOLS.



CYLINDER BORING MACHINE.

THE **NILES TOOL WORKS** CO.,
HAMILTON, OHIO.

To Those Interested In, or Using Valves:

We have recently made improvements in the manufacture of **JENKINS BROS.' VALVES**, having increased the number of bolts, thickness of flanges, etc. We shall manufacture **ONE GRADE OF VALVE ONLY**, suitable for high or low pressure steam. The Jenkins Discs used in these valves are suitable for high or low pressure. We guarantee all valves stamped with Trade Mark.

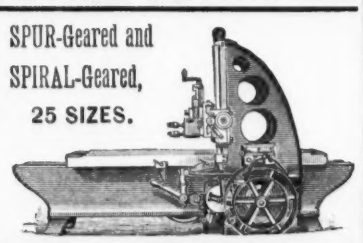
JENKINS BROS.
New York, Boston, Philadelphia, Chicago.

BEMENT, MILES & CO., PHILADELPHIA, PA.
MANUFACTURERS OF
METAL WORKING MACHINE TOOLS
For RAILROAD SHOPS, LOCOMOTIVE AND CAR BUILDERS, MACHINE SHOPS, ROLLING MILLS, STEAM FORGES, SHIP YARDS, BOILER SHOPS, BRIDGE WORKS, ETC., ETC.

STEAM HAMMERS,
STEAM and HYDRAULIC RIVETING MACHINES.

PLANERS

SPUR-Geared and SPIRAL-Geared, 25 SIZES.

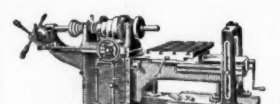


MANUFACTURED BY
The G. A. GRAY CO.,
477-483 Sycamore St., CINCINNATI, O.
New York Store, 121 LIBERTY STREET.

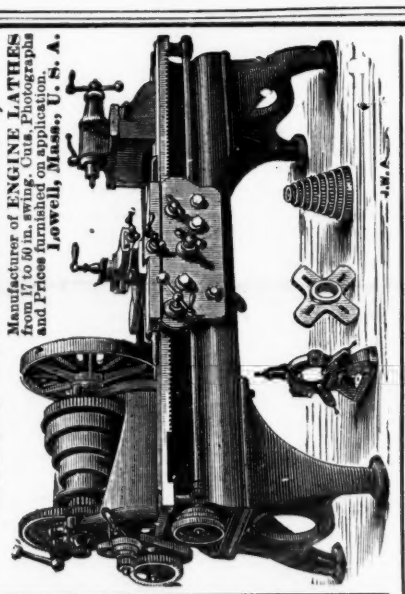
THE GARVIN MACHINE CO.,
MANUFACTURERS OF
UNIVERSAL
Cutter and Tool Grinders,
PLAIN AND UNIVERSAL MILLING MACHINES,
SCREW MACHINES, TAPPING MACHINES, GEAR CUTTERS,
HAND LATHES, DRILL PRESSES, SPRING COILERS, ETC.
SPECIAL BICYCLE MACHINERY.
ALSO DEALERS IN
METAL WORKING MACHINERY
OF ALL KINDS.
Over 600 Various Machine Tools for Immediate Delivery.
Laight and Canal Streets, - New York.
Also 51 N. 7th St., - Philadelphia, Pa.

THE PRATT & WHITNEY CO.,
HARTFORD, CONN., U. S. A.,
Invite correspondence from all who have use for Forging and Finishing Machinery, with Dies, Fixtures, Milling Cutters and Gauges, for the manufacture, on the American System of Interchangeability of Parts, of Fire Arms, Sewing Machines, Bicycles, Typewriters, Electrical Apparatus, etc., or for Machines and small tools for finishing brass in the forms of Gas Fixture Joints and Keys, Locomotive Fittings and Plumbers' Goods.
New York Warerooms: 136-138 LIBERTY ST.
Western Branch: 98 WASHINGTON ST., CHICAGO, ILL.

DROP FORGINGS AND MACHINISTS' TOOLS
OF EVERY DESCRIPTION.
UNEQUALLED IN QUALITY AND FINISH.
THE BILLINGS & SPENCER CO.,
HARTFORD, CONN., U. S. A.
Chicago Office: 17 S. CANAL STREET,
England—CHARLES CHURCHILL & CO., 23 Cross St., Finsbury, London, E. C.
France—L. ROFFO, 58 Boulevarde Richard Lenoir, Paris. *Russia—J. BLOCK, Moscow.*



WARNER & SWASEY,
CLEVELAND, OHIO.
MANUFACTURERS OF
HORIZONTAL
BORING MILLS.
IRON AND BRASS WORKING MACHINE TOOLS.
SEND FOR ILLUSTRATED CATALOGUE.



GEO. W. FIFIELD,
Manufacturer of ENGINE LATHES from 17 to 60 in. swing. Cuts, Photographs and Prices furnished on application.
Lowell, Mass., U. S. A.

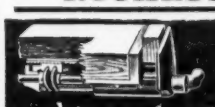
THE HAYDEN & DERBY MFG. CO.,
SOLE MANUFACTURERS
METROPOLITAN INJECTORS,
AUTOMATIC and DOUBLE-TUBE.
THE MOST RELIABLE INJECTORS MADE.

SEND FOR CATALOGUE "1893."

Awarded the highest reward and medal for Metropolitan Automatic Injectors Metropolitan Double Tube Stationary Injectors Metropolitan Double Tube Locomotive Injectors, and D. H. Injectors

OFFICE AND SALESROOMS:
No. 111 & 113 LIBERTY ST., NEW YORK.

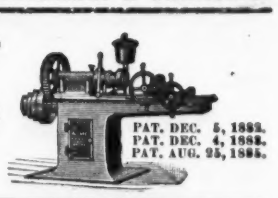
UPRIGHT DRILLS,
CUTTING-OFF MACHINES,
KEY-SEATING MACHINES
AND
SPECIAL MACHINERY.
Write for Catalogue and Prices.
THE W. P. DAVIS MACHINE CO.,
ROCHESTER, N. Y.



WYMAN & GORDON
WORCESTER, MASS.
DROP FORGINGS
— WOOD WORKERS' VISES —

J. M. ALLEN, President
WM. B. FRANKLIN, Vice-President.
F. B. ALLEN, Second Vice-President.
J. B. Pierce, Secretary & Treasurer.

THE ACME MACHINERY CO.
CLEVELAND, OHIO.
Manufacturers of
ACME BOLT & RIVET HEADERS,
Acme Single and Double Automatic
BOLT CUTTERS.
Cutting from 1-8 in. to 6 in. diameter.
Also SEPARATE HEADS and DIES.



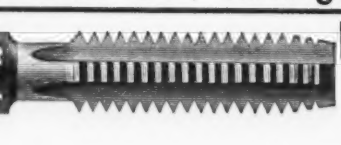
MACHINE TOOLS AT REDUCED PRICES.

In order to reduce our stock, we offer 16″, 18″, 21″ and 24″ engine lathes, 16″, 22″, 24″ and 27″ planers, 10″, 12″ and 15″ speed lathes, 15″ and 20″ turret lathes, at a good discount from former prices.

We also have a few 16″ and 18″ second-hand engine lathes, in good order, and of our own make.

THE HENDEY MACHINE CO., Torrington, Conn.

J. M. CARPENTER
PAWTUCKET, R. I.



Manufacturer —of— **TAPS & DIES**